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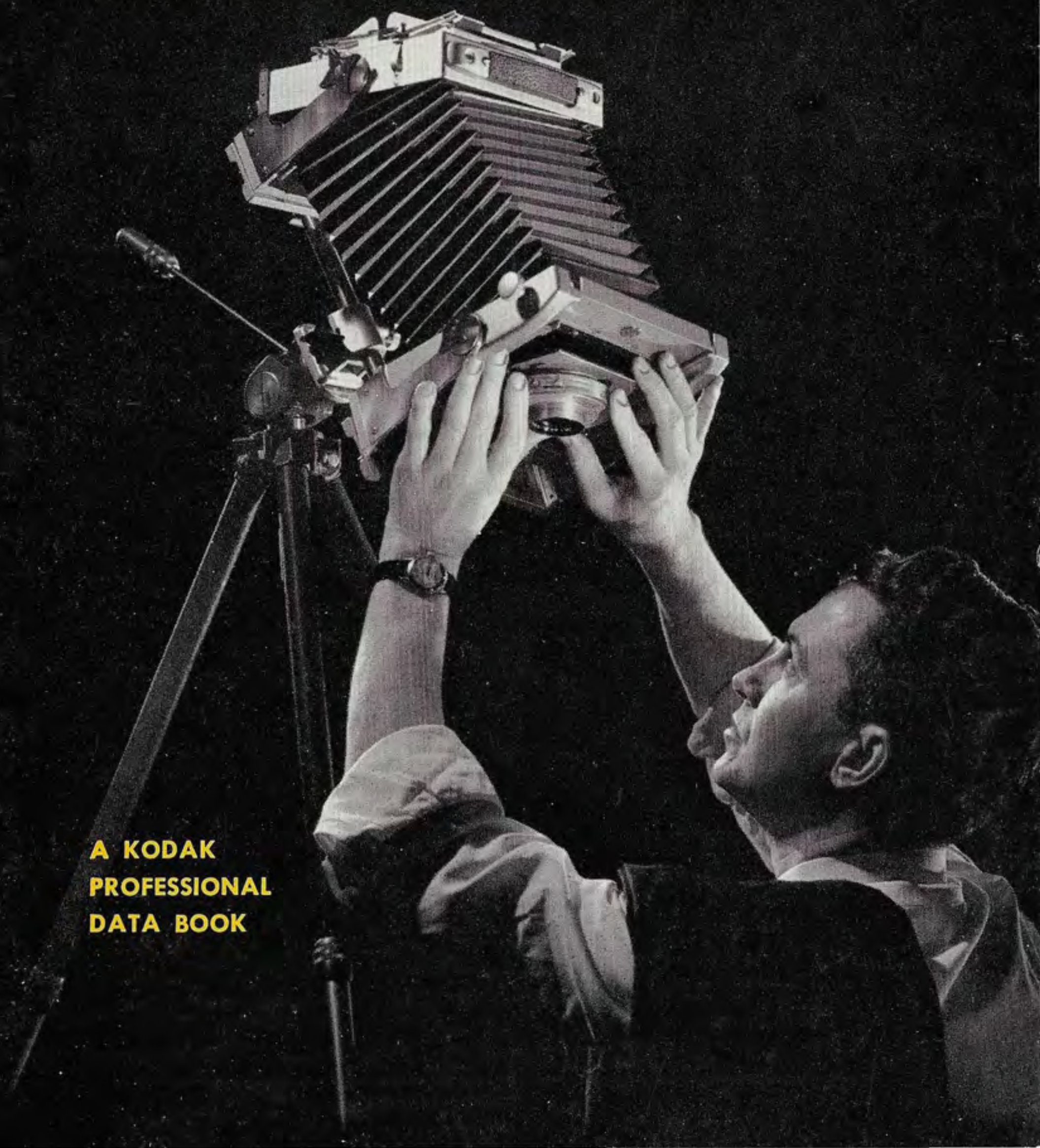
CAMERA TECHNIQUE

for Professional Photographers



A KODAK
PROFESSIONAL
DATA BOOK

CAMERA TECHNIQUE

for Professional Photographers

• The camera technique of a professional photographer is dependent considerably on the lens used. Therefore, the choice of a really fine lens is perhaps the most important decision with respect to equipment that a photographer is called upon to make. His future photography rests not only on the quality of the lens itself, but also on the suitability of the lens for the tasks it is to perform. The drawing and perspective of the image formed by a lens depend upon the point of view —the lens-to-subject distance—not on the lens. Yet, the area of the scene covered and the size of the image are functions of the lens, and these, in turn, often are the factors which determine where the camera is placed. The covering power and the focal length of lenses therefore regulate their suitability for a given purpose.

In addition to these factors governing the choice of a lens, there are the limitations imposed by the bellows draw of the camera and the desired swings and other camera adjustments the photographer may wish to impose on the camera image. Thus it is that the choice of a lens and the problem of camera swings are interdependent.

This is the material covered by the following pages in this Kodak Professional Data Book. The information on choosing lenses will be helpful as a guide to either the purchase of a new lens or the use of a lens in a specific photographic situation.

The related section on view-camera adjustments is presented in the hope that it will help to straighten out much of the misunderstanding of the purpose and practical application of these adjustments. In particular, it should help new professional photographers to proceed in a methodical manner in setting up a view camera so that the focus, depth of field, and perspective will give the quality of results desired.

Incidentally, high image quality is not an intangible entity that must be taken on faith alone. It is something that the eye can see. The Kodak lenses discussed in these pages are presented with pride, and in the secure knowledge that here are the finest lenses we know how to make—lenses that meet the requirements of the most discriminating professional photographers.

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First Edition, 1952—First 1953 Printing

THUMB INDEX

The Lens for the Job

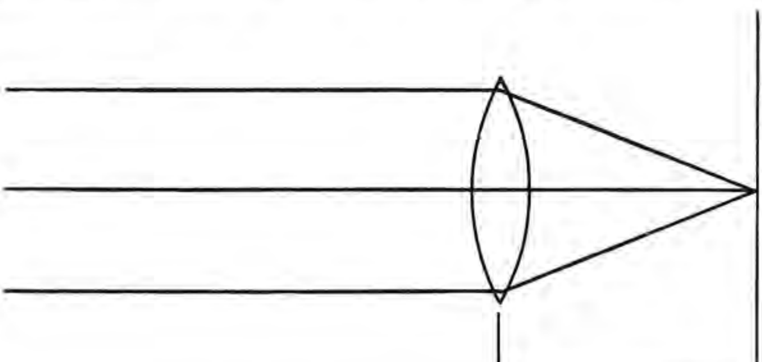
• A lens is a tool designed for specific application. It is therefore important for optimum results in any photographic application to select a lens designed for that application and to remember that the differences between lenses of different types are large. Thus, the professional photographer is very much concerned with the problem of choosing the lens best suited to the job every time a photograph is to be taken.

Several factors must be considered when selecting a lens. They will be discussed as they apply in particular to the problems of the professional photographer.

FOCAL LENGTH AND COVERING POWER

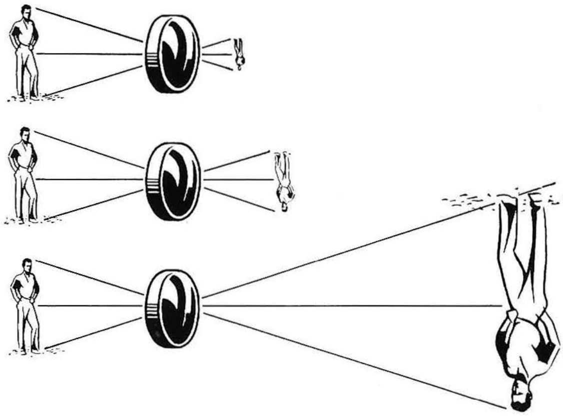
In general, the focal length and covering power of lenses regulate their suitability for a given purpose.

What is focal length? It is quite usual to think of the focal length of a lens as the distance from the lens to the position of the image it forms of a distant object. For single, thin lenses this distance is a very good approximation. This is shown in the diagram below.

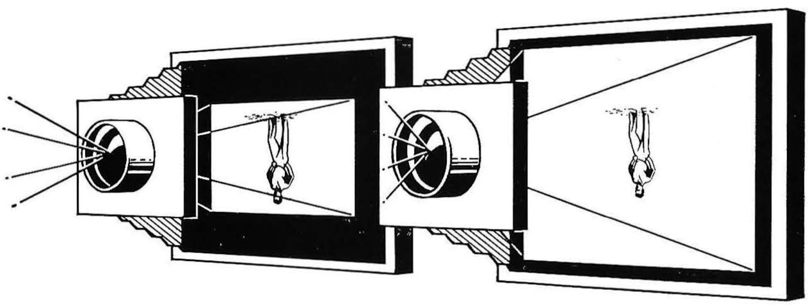


What, then, does the focal length of a lens tell about its performance? It is necessary to think of focal length as a property of a lens, rather than as a distance, even though focal length is measured in millimeters or inches. This property determines how large an image, that is, the image size, the lens will form at a given distance from the

object. For example, as shown below, consider a man six feet high to be at a distance of 25 feet from a 1-inch lens; the lens would form an image of him about ¼ of an inch high. A 2-inch lens will form an image twice as high; a 6-inch lens, six times as high; and so on. Note carefully that in this discussion we use the term "image size" to mean the dimensions on the negative of some portion of the subject, as contrasted with the whole area covered by the lens, which we will call "covering power."



It is important to realize that it is the focal length and not the type of lens that determines how large an image is formed by the lens; all lenses of the same focal length and at the same subject distance produce images of the same size, whether they are called telephoto lenses, wide-angle lenses, or by any other name. It is shown in the following diagram that a 6-inch telephoto lens for 16mm motion pictures forms an image of a given object which is the same size as the image of that object formed by a 6-inch wide-angle lens used on an 8 x 10-inch



Made with a Kodak Commercial Ektar Lens, f/6.3.

view camera, when the object is at the same distance.

A glance at the diagram at the bottom of page 3 will show another factor of importance. It will be seen in the figure that although the size of the image is the same with each of these lenses, one lens includes much more of the scene than the other. The extent of the scene included by the lens is called its "covering power," and for convenience is often described in terms of the angle of view.

The angle of view does not depend on the focal length of the lens. A lens of a given design may be made in a series of focal lengths so that we get different scales of the picture even though the angle of view is the same. Of course, this presupposes that the negative in each case is large enough to include the full angle of view of the lens.

When lenses are designed for definite applications, the designer takes into account, among other factors, the angle of view (angular field) to be covered. If it is small, he is usually able to correct the lens to a higher degree and often to make it with a larger relative aperture. If the angular field is very large, he may find it desirable to keep its relative aperture low in order to obtain good correction over the wide field.

For example, as represented on page 3, there are 100-mm (4-inch) lenses for several purposes. A 100-mm lens for 16mm motion pictures is required to cover a negative with a diagonal of only one-half inch, and hence the angular covering power required is small, only about 7 degrees. The normal 100-mm camera lens covers a 2¼ x 3¼-inch film size, and to do this must be designed to cover a picture with a diagonal of nearly 4 inches. The angular covering power of this lens must be about 54 degrees, and the area covered is over 60 times greater than that of the motion-picture lens. Again, a 100-mm wide-field lens can be used to make a picture 4 x 5 inches in size, with a diagonal of nearly 6 inches and an angular covering power of nearly 80 degrees, which includes three times the area covered by the ordinary camera lens. In spite of this great variation in field, it must be remembered that the size of the image of objects at equal distances from these three lenses will be identical on the film. It is merely a question of how much area of the subject is to be included in the picture. Additional information on covering power is given on pages 29 and 30.

And so it will be seen that there are two separate items to be considered: First, the size of the image on the film is determined by the focal length of the lens and is independent of its covering power. Secondly, the angular covering power, or angle of view included, depends upon the design of the lens and not upon its focal length.

Usual Focal Lengths

In general, when a lens will cover a film whose diagonal dimension is approximately equal to the focal length, it is considered a normal lens. In many kinds of photography, pleasing results are obtained with a normal lens.

In portraiture, it is customary for the lens to have a focal length of from one and one-half to two times the diagonal of the negative. This enables the photographer to work at a sufficiently great camera-to-subject distance to obtain a pleasing perspective of the subject when the image size fills the proper proportion of the negative. Lenses for portraiture are discussed further on page 19.

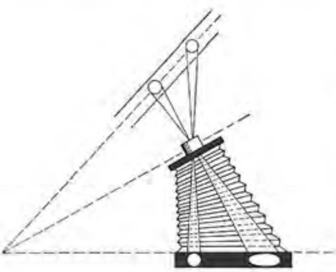
In press photography, it is not uncommon to use a lens of a shorter focal length than the diagonal of the film so that a closer viewpoint can be used and still take in the entire scene, even at the expense of poorer perspective. The actual diagonal of a 4 x 5-inch film, for example, is 6⅜ inches, which means that a lens of similar focal length would be normal. However, corner definition is often of less value than the advantage of increased angular coverage and increased depth of field over a normal lens, and it has become customary to use the 127-mm (5-inch) lens on a 4 x 5-inch camera, even though it is designed to cover only a 3¼ x 4¼-inch negative. Furthermore, it is customary for press photographers to enlarge only the central area of their negatives, and when complete coverage is essential, the 127-mm lens can be well stopped down so that it will cover a 4 x 5-inch film.

Long-Focus and Telephoto Lenses. Lenses that produce enlarged images (relative to a lens of "normal" focal length) can be of two types —long focus and true telephoto, although it is not uncommon to hear all such lenses referred to as "telephoto lenses." In performance, the two types are similar in that they produce the same image size, as that is merely a function of focal length, but there is a difference in the optical design. The telephoto lens is so constructed that it is physically shorter than a conventional lens of equal focal length which reduces its bulk and weight. This is also an advantage in that it reduces the bellows extension required and permits longer lenses to be used with a given camera bellows. In other respects, the telephoto lens has no distinct advantage over a lens of conventional design; in fact, it may sometimes be inferior in its optical characteristics. Incidentally, no telephoto lens will cover an angular field greater than 30 degrees, i.e., a diagonal less than half its focal length.

Long-focus lenses, as the term is used here, include those of the telephoto type, and are those in which the focal length considerably

exceeds the negative diagonal. They are employed when it is desired to obtain a larger image of the subject from a fixed camera position on relatively small film sizes.

Wide-Angle and Wide-Field Lenses. Lenses with a focal length appreciably shorter than the diagonal of the negative are known as "wide-angle" or "wide-field" lenses, since they include more of the scene than a normal lens on the same film area. For the purpose of this discussion, a wide-field lens, generally speaking, covers an angle of from 55 degrees to 80 degrees, while a true wide-angle lens covers an angle greater than 80 degrees. The technique of using these helpful "tools" is discussed in subsequent paragraphs.



The above illustration shows two Ping-pong balls on a glass plate. Both balls were round and of equal size, as is proved by the illustrations on page 11 which include the entire subject. The intentional distortion, emphasized by the cropping, is a combination of both foreshortening and wide-angle distortion. The diagram at the left shows the camera-to-subject relationship. Viewed obliquely from the side, the larger ball can be made to appear round.

Another example of intentional distortion, but with an acceptable, dramatic result.

IMAGE DISTORTIONS

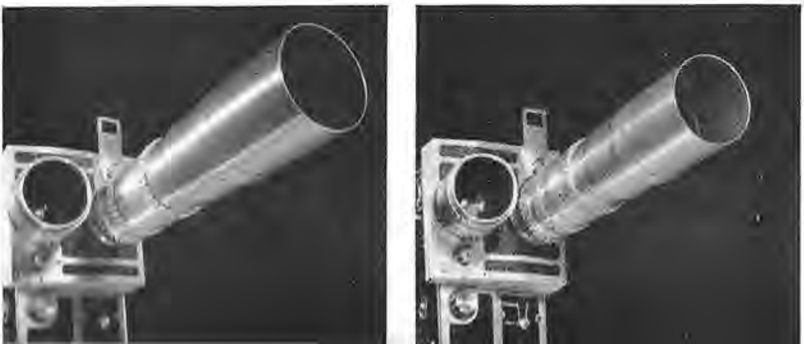
Linear Distortion. There are several types of unrelated distortion encountered in the use of lenses. The first, a property of the lens design itself, is found mainly in the simpler types, and may result in "pincushion" or "barrel" distortions. These terms refer to the approximate shape of an image of a rectangular subject formed by the lens. Since these effects are usually limited to the lenses of box cameras and to a few telephoto lenses, and are not a problem in Kodak Ektar Lenses or in Kodak Portrait Lenses, they can be ignored by the professional photographer.

Foreshortening. Another common type of perspective distortion most noticeable in portraits is often referred to as "foreshortening." This is also independent of the lens design. It is merely the result of a choice of camera position too close to the subject to represent a satisfactory viewing distance; as a consequence, the usual viewing distance for the resulting print is too great. Too small a studio is often the cause of this trouble; otherwise, the same trouble may result from the use of a lens of too short focal length. In this case, to obtain a large image, the photographer may be tempted to crowd up to the subject. Here again, the perspective can be improved even with the use of a lens of short focal length, if the camera is placed at sufficient distance and the image is increased in size by subsequent enlargement. For example, if a 6-inch lens is used to make the original, a 4-times enlargement would give good proportions for viewing.

Unfortunately, the word "distortion" has come to be used for these three entirely different effects. Of them, only linear distortion can be attributed to poor quality in the lens. Both the other types can be kept within reasonable limits by good practice.

Another very common type of distortion is the "Keystone effect," caused by tilting a camera downward or upward before or during exposure. This effect and its remedy are discussed on page 35.

Camera-to-subject distance controls perspective. The foreshortened example was taken with a 6-inch lens, but the more normal result was taken with an 18-inch lens.

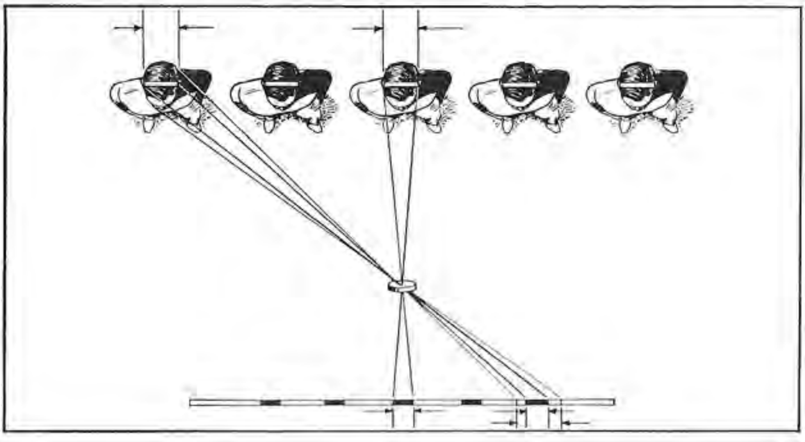


Perspective or Wide-Angle Distortion. There is a distortion encountered in wide-angle photography that is sometimes wrongfully blamed on the lens. This is perspective distortion, by reason of which three-dimensional objects at the edges of the field appear greater in width than similar objects at the center of the field. It is, however, not related to lens design; in fact, it would occur even if a pinhole were used to form the image. It does not exist when a lens is used for copy work, unless the lens has certain types of aberration for then there is no perspective involved, but it is important when three-dimensional objects are to be reproduced. Also, the wider the angular field of the lens used, the more noticeable it becomes. When cylindrical or spherical objects are placed near the edge of the field of a lens, the width of the images on the film is greater than when they are reproduced in the center of the field. This effect is especially visible and objectionable when groups of people are photographed with wide-field lenses: those near the ends of the group appear wider than they actually are. This is particularly noticeable in the case of faces.

This apparent distortion is a normal effect. It is produced by the necessity of recording three-dimensional objects in two dimensions. The effect is visible only when the negative of a print from it is not viewed from the correct spot. It is usual to view the print with both eyes and without taking any particular precautions as to where the eyes are placed. It is this lack of precaution in viewing which introduces the apparent distortion.

If the negative bearing the distorted image described above is

Spheres similar in shape may not record similarly with wide-angle lenses. Lens design is not to blame, since the same effect can occur in images made with a pinhole camera.



viewed with only one eye from a distance equal to the focal length of the taking lens, all the images of the spheres will at once assume their proper round appearance, and everything will look normal and much more realistic. Of course, unless the focal length of the lens is at least 10 inches, viewing a negative in this way is difficult without either enlarging the print or observing it through a magnifier with a focal length about equal to that of the taking lens.

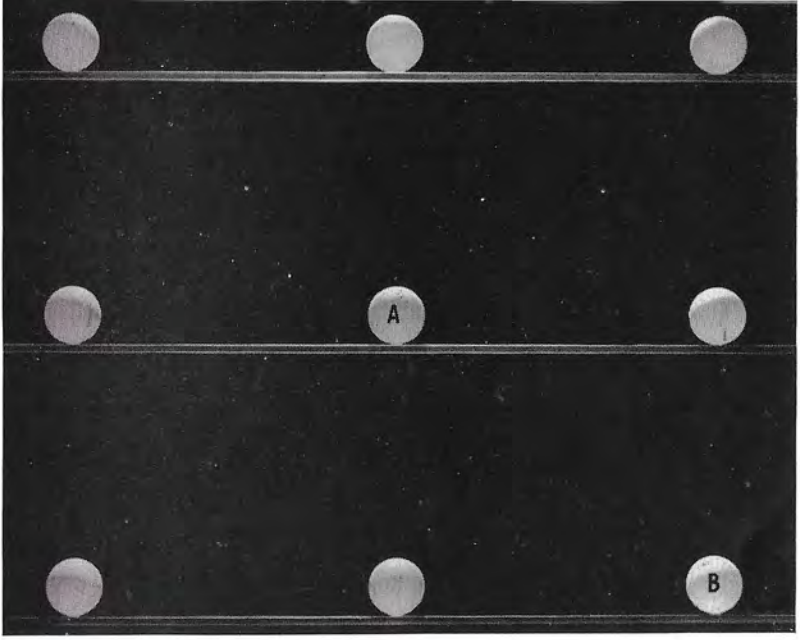
A normal lens has a focal length about equal to the diameter of the circle within which it makes a good image; e.g., on an 8 x 10-inch area which lies within a 13-inch circle, a lens of 12 to 14 inches in focal length gives good results. With such a lens, a man's head appearing near the corner of the picture will be about 10 percent too wide in a direction toward the corner of the picture, as shown on the next page. However, when an extreme wide-angle lens with a focal length of about 6 inches is used, the amount of distortion at the corner of the film becomes much larger, and a head so placed will be widened in the photograph to nearly 1½ times its normal size, as seen in the center of the picture.

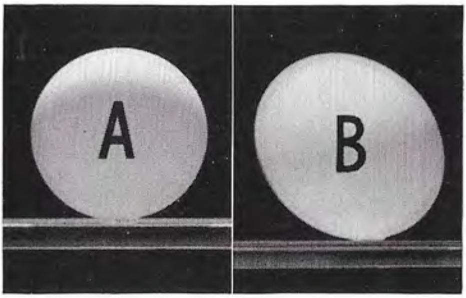
The extent to which such distortion can be accepted can be determined only by trial. It has been found in actual practice, however, that about 10-percent distortion can be tolerated in photographs of people. This degree of distortion is obtained at about 23 degrees from the axis of the lens. When people are further off axis than this, the distortion becomes objectionable to them and to their friends.

In commercial photography, there may be some instances where a 10-percent distortion cannot be tolerated. An example would be when symmetrical objects of a known shape, such as lamp shades, are photographed. In fact, it is often surprising how quickly such objects can be distorted to the point where the distortion is noticeable even though the picture is acceptable for certain purposes. Again, it should be emphasized that the distortion is not caused by the lens, but by the angles involved.

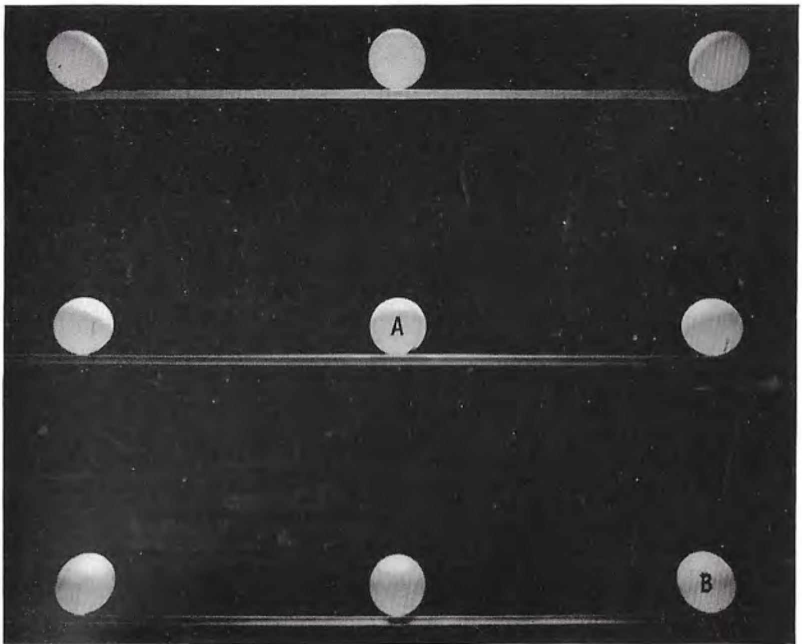
The most general method of minimizing this trouble is to reduce the angular field covered by the lens by moving the camera farther from the subject. This, in turn, means making enlargements to get the desired image size in the final print or using a lens of longer focal length to maintain the desired size in the negative. Wide-angle distortion cannot be corrected by camera swings.

When it is necessary to work at subject distances that result in these distortion-producing angles, it is sometimes possible to minimize the unpleasant effects by more careful posing of the subjects. In making



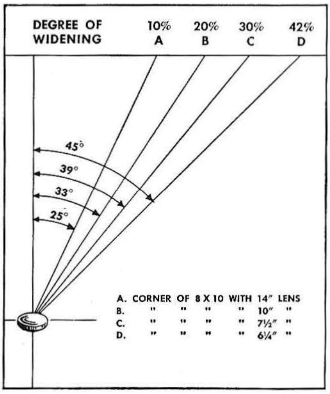


The identical Ping-pong-ball subject was used for these illustrations. The picture at the bottom was taken with a 135mm wide-angle lens, and the one at the top with an 18-inch lens. The relative difference between the center and the corner balls in the picture below is shown more clearly in the enlargements at the left.



Made with a Kodak Wide Field Ektar Lens, f/6.3.

group pictures, the photographer should, if possible, keep large-featured individuals nearer the center of the picture, and small-featured individuals at the ends. Sometimes it is helpful to turn the individuals at the ends slightly towards the center so that they are not photographed with both ears showing. The hands should also be positioned so they do not present a broad surface in the picture.



This diagram shows the approximate elongation of spherical or cylindrical objects at the angles indicated. The elongation is independent of lens design and is merely a matter of the angles involved.

Here is a problem which may arise in connection with wide-angle photography: Suppose you now have a 14-inch lens and are considering the purchase of a 10-inch wide-field lens for special use in photographing wedding groups. The question before you is whether or not the degree of perspective distortion would be tolerable for people at the ends of the picture. The effect that will be produced by a 10-inch lens can be duplicated on a test basis with your 14-inch lens if your camera has a sliding front and/or back. The procedure is as follows:

Set up the camera so that the lens axis is two inches to one side of the center of the 8 x 10-inch negative on the horizontal plane. The lens board, of course, should be held parallel to the film. Compose a group 14 feet wide. This will result in half of the picture being the equivalent in width to half of the long dimension of an 11 x 14-inch picture, in which case the angle on that side alone will be about 26 degrees. The perspective distortion on the subject at that end of the line will be about the same as that produced by a lens of 10-inch focal length used on its axis with 8 x 10-inch film. If you feel that you can regularly tolerate this amount of distortion, and the reduction in the size of the camera room is essential, then a 10-inch lens that covers an 8 x 10-inch area, such as the Kodak Wide Field Ektar Lens, 10-inch *f*/6.3, might be worthy of consideration.

SHARPNESS CONSIDERATIONS

The term "definition" refers here to the ability of the lens to form a clear and "crisp" image of fine detail. Many factors affect photographic definition—first of all, the lens itself; then the subject, choice of film, lighting, contrast, development, freedom of the camera from vibration during exposure, and many other factors; and last but not least, the accuracy with which the film registers in the plane of the ground glass (that is, the focusing accuracy).

In addition to reducing the lens speed, increasing the depth of field, and controlling the accuracy with which the lens needs to be focused, decreasing the lens aperture from its maximum opening improves definition by removing the small amount of haze. This usually results in a slight increase in image contrast. As a general rule, the best balance between maximum definition and high speed is made by closing down the diaphragm from wide open—about two stops for moderately fast lenses, such as $f/4.5$'s, and about three stops for faster lenses. Photographic lenses, regardless of make, always improve in definition as they are stopped down below their maximum aperture. The photographer should not hesitate to take advantage of this fact when the very sharpest definition is called for.

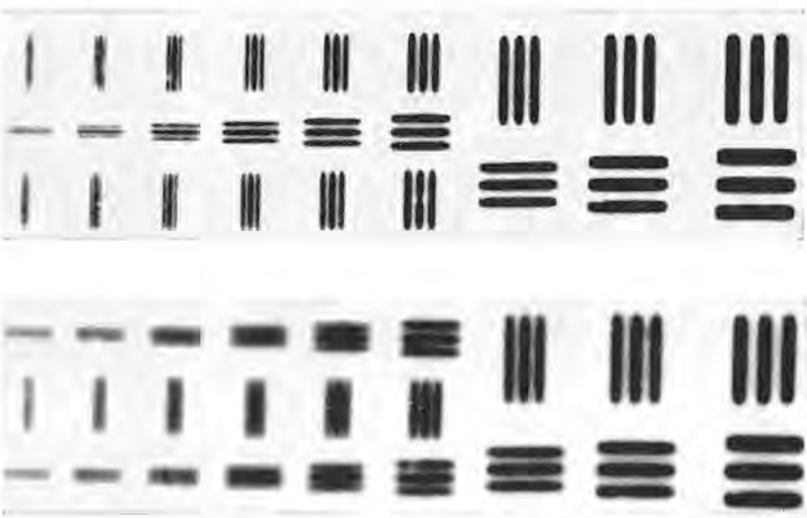
It is interesting to note, however, that the nature of light sets an ultimate limit to the improvement in definition as the aperture is stopped down. A beam of light passing through an aperture does not continue unchanged, but spreads slightly at the aperture edge in a manner similar to the spreading of water waves after passing through a small opening in a breakwater. This is known as diffraction. The smaller the opening, the greater the spreading. Only in very special cases is this effect of any consequence for apertures larger than $f/22$, but where depth-of-field considerations or exposure conditions force the use of very small apertures, falling off in definition, particularly in the center of the field, can be seen by critical observation. The effect with a particular f-number is, of course, dependent on the focal length of the lens. With 14 to 20-inch lenses, the definition at $f/32$ is probably acceptable, but even at $f/22$ the definition may be seriously affected with some 2-inch lenses. Generally speaking, crisper definition is required in commercial photography than for portraiture.

LENS-SPEED CONSIDERATIONS

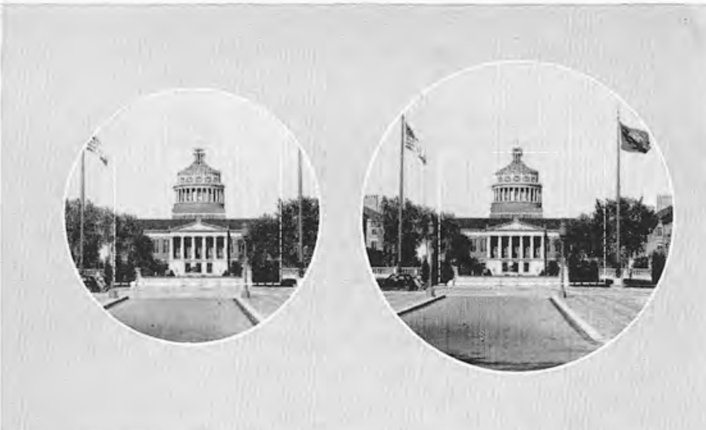
Maximum Aperture: Only occasionally does a professional photographer set his lens at its widest aperture for picture taking, but practically every lens is focused at this setting. Here is where a fast

lens becomes a great convenience, for an aperture of $f/4.5$ yields a ground-glass image with twice the brightness produced by an aperture of $f/6.3$. Therefore, the photographer can focus more critically because he can see the image more clearly. Then, too, at wide apertures there is less depth of field, and the point of critical sharpness is easier to discern. Of course, wide apertures can also be used for photography when there is a need for such speed.

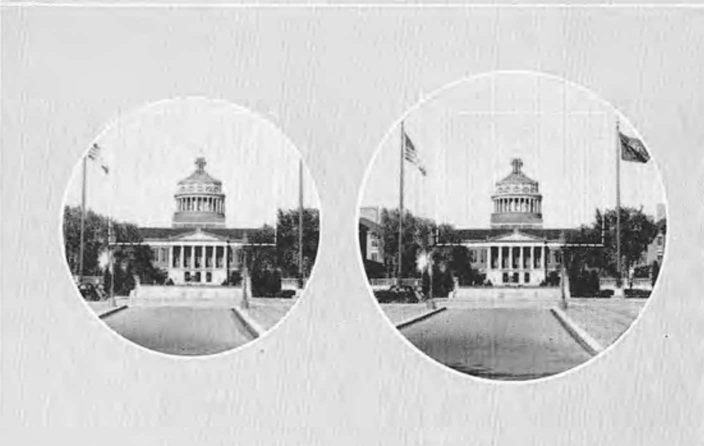
Minimum Aperture: Professional photographers, particularly those doing commercial work, are usually as much interested in how far a lens can be stopped down as they are in its maximum speed. Not all lenses have the same minimum aperture. On some lenses it will be found possible to move the diaphragm pointer past the smallest indicated aperture, but even if this is possible, this practice is not recommended, in general, for two reasons: First is the problem of working at an unknown aperture, but more serious is the fact already noted that, at very small apertures, the spreading of the image caused by diffraction renders it less sharp and may more than cancel any increase in depth of field that may be gained.



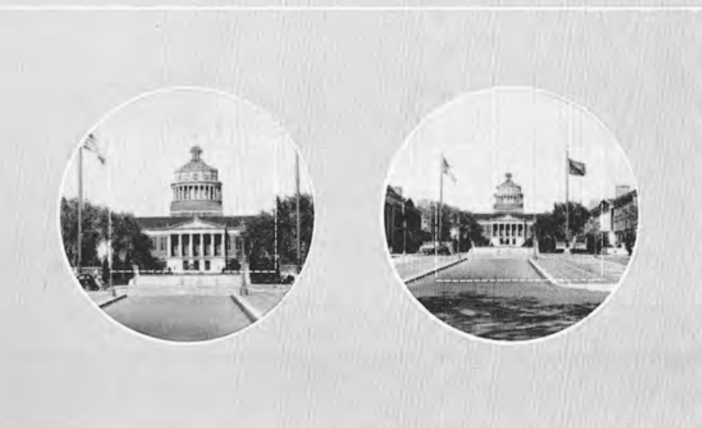
These reproductions of X13 enlargements from two test negatives—about 5/16-inch wide —demonstrate the loss in definition which occurs in stopping down a lens from $f/16$ (at the top) to $f/90$ (at the bottom). In other words, extremely small lens apertures do not produce the sharpest images. The critical aperture, at which best definition is obtained, is found by closing down the diaphragm about two or three stops from the maximum aperture.



(a) At the left, the image formed by a Kodak Commercial Ektar Lens, f/6.3; at the right, that formed by a Kodak Wide Field Ektar Lens, f/6.3. Both lenses have the same focal length. If the same camera had been used with each, the resulting pictures would be identical.



(b) However, using the same lenses, the larger image circle of a Kodak Wide Field Ektar Lens, f/6.3, permits a greater rising-falling front movement and other adjustments without corner cutoff.



(c) When a Kodak Wide Field Ektar Lens, f/6.3, of a focal length less than that of a Kodak Commercial Ektar Lens is used, a wide-angle effect results. Note that the image circle of the Kodak Wide Field Ektar Lens on the right is the same size as that of the Kodak Commercial Ektar Lens on the left, but the size of the objects in the image is smaller; therefore, more objects are included.

WIDE-FIELD COVERAGE

While the photographer is accustomed to the thought that his lenses form rectangular pictures, in reality they cover a circular field, the usable rectangular area of which appears on the ground glass. When the area used is greater than it should be, definition in the corners falls off because the corners of the rectangular area exceed the periphery of the circular picture. The coverage of a lens therefore refers to the diameter of the circular picture in which the definition is satisfactory for the purpose intended.

This circular image is shown diagramatically on the opposite page. For an actual example, see the illustrations on page 31.

Obviously, the linear size of the image circle depends not only on the angular covering power of the lens; it is also dependent upon the focal length. A 5-inch lens with the same angular covering power as a 10-inch lens would cover only one-quarter of the film area, but it would cover the same scene area at any given distance. Thus, the so-called "wide-angle" lenses are those whose actual covering power is greater for a given focal length than that of a normal lens. Kodak Wide Field Ektar Lenses differ from other wide-angle lenses in being usable at larger apertures and in having especially good lateral color correction.

Wide-angle lenses usually have small maximum apertures, and the problems of perspective, as discussed previously, are difficult even though the definition is acceptable and the other corrections of the lens are satisfactory. Therefore, they are used only when absolutely necessary—for example, for a banquet scene or where a considerable area of a room must be pictured. However, there are many occasions when more than normal coverage is desired, yet both a flat field and good definition are necessary. This is particularly true when the lens board must be raised or lowered, or the tilting lens board used.

Here, then, are the qualities which recommend the use of Kodak Wide Field Ektar Lenses: wide angular coverage, excellent color correction, and added lens speed for ease of focusing. They can be used for either of two reasons: Because their wide coverage is useful at the film to accommodate camera adjustments, or because, in a shorter focal length, they increase scene coverage. As can be seen in the accompanying illustrations, when the photographer changes from a 10-inch lens of regular covering power to a 7½-inch Kodak Wide Field Ektar Lens, the image circle size remains practically the same, but the sizes of individual objects are smaller, thus including a wider scene area in the same film space.

Made with a Kodak Ektar Lens, f/4.5.

LENSES FOR PORTRAITURE

In general, the focal length of a lens used for head-and-shoulder portrait work should be from 1½ to 2 times the diagonal of the film. For three-quarters portrait work, a focal length equal to the length plus the width of the film is suggested.

The sharpness is often a matter of personal preference. For example, although the Kodak Commercial Ektar Lenses are meant principally for producing the finest quality in commercial photography, they can also be used for portraiture whenever a brilliant, superbly sharp image is desired. Or, they can be used with a diffusion disk for softer results.

For photographers who wish to "soften" a measure of the "hardness" produced by the usual camera lens, there are a number of soft-focus portrait lenses available. Some of these achieve their soft effects by means of chromatic aberration, which is simply a color focusing fault in the lens and results in unsharp pictures. With these lenses, the image as viewed by the eye is not the same as that recorded by the film. Hence, the exact diffusion cannot be known until after the negative is processed. Furthermore, the effect varies with the color sensitivity of the film.

The Kodak Portrait Lenses, however, are highly corrected for chromatic aberrations and have identical visual and photographic images. Before releasing the shutter, the photographer can see on the ground glass the exact effect he will obtain, and furthermore, the soft-focus effect can be controlled by varying the aperture. When the lens is used wide open at *f*/4.5, the soft-focus effect is most pronounced, while at *f*/22, the effect disappears almost completely. This feature is extremely valuable for both portrait men and advertising illustrators. In addition, because the soft-focus effects "smooth out" blemishes, etc., much of the need for retouching portrait negatives is reduced. The design of the lenses is such that at the larger stops each highlight point in the scene will be surrounded by a soft halo, often described as a "pearly highlight." The lenses are equally suitable for black-and-white and color.

Focusing the Kodak Portrait Lens

Using sharp-focus lenses, the customary technique for portrait subjects is to focus on the catchlights in the eyes. With this technique, the normal depth of field assures satisfactory sharpness for the subject's nose. However, as the instruction manual points out, this same focusing technique cannot be used for the Kodak Portrait Lens since

there is no appreciable depth of field in front of the point focused on. The subject's ears may be rendered crisply, but the nose is slightly blurred, which is just the opposite of the desired result.

There are two focusing techniques which can be used satisfactorily with the Kodak Portrait Lens. The first is to focus on that part of the subject which is nearest the camera, so that the other important parts of the head automatically come within the depth of field. In the usual

A Kodak Portrait Lens was used at f/4.5 at the left, f/22 at the right. Customarily, this lens is used at an aperture of about f/8 to produce a degree of diffusion intermediate to those illustrated here. It is very important to focus this lens at a given stop and then expose at the same stop.

full or three-quarters view, this means focusing on the tip of the nose. As a suggestion, focus the lens at $f/8$ and then open the diaphragm one stop for the exposure. Opening the diaphragm more than one stop will increase the softness. The important thing is, *never focus this type of lens at a given stop and then expose at a smaller stop.*

The second method, which many photographers may find easier to follow, is based on the ordinary method of focusing on the catchlights, but it incorporates standard corrections for various image sizes to allow for the lack of depth of field in front of the focused plane. The following steps outline this method:

1. Set the diaphragm at the regular working aperture.

2. Focus on the catchlights in the eyes, or if this is not practical, perhaps because of head position, choose some convenient intermediate point as would usually be done when working with a conventional sharp-focus lens. In focusing, however, remember that since all depth of field is behind the focused point, the greatest bellows extension which gives a sharp image is the setting at which the subject is in critical focus. If the subject is thrown out of focus by extending the bellows, and then the bellows is racked in until the image of the catchlights *first* becomes sharp, the catchlights will be in critical focus.

3. It is now necessary to move the point of focus forward from the catchlights to about the tip of the nose in order to include the whole face within the depth of field. This is done by racking the bellows out by an amount which varies with the image size of the head as follows:

Rack out about ⅛-inch for a 2-inch head;

Rack out about ⅜-inch for a 3-inch head;

Rack out about ½-inch for a 5-inch head.

Allowance For Unusual Features. These are approximate figures which give pleasing results when either the 12-inch or the 16-inch lens is used for an average face. These distances must therefore be modified slightly for a face with a rather long nose or deepset eyes, or for one which departs noticeably from the average in other ways. It should be kept in mind in making all adjustments that the negative will record just what the photographer sees.

If the bellows is racked out a little farther than the distances listed, thus moving the point of focus farther forward, the resulting picture will have still more of the diffuse, soft-focus effect. In fact, many photographers prefer pictures made in this way.

A small ruler taped along the camera bed will be an aid in making the measurements quickly and easily.

LENS SELECTION FOR 4 x 5-INCH FILM

The following suggestions are given as a guide for general professional photography, keeping in mind the requirements of commercial, portrait, and news work.

Minimum Lens Equipment. If only one lens is to be purchased, the Kodak Wide Field Ektar Lens, 135mm *f*/6.3 is suggested. Its focal length is long enough to give normal perspective for general photography, and yet permits adequate subject coverage in cramped interiors, a situation often encountered in candid wedding photography and in many indoor news assignments. Because this particular lens has a reserve of covering power when used with a 4 x 5-inch camera, it also permits full use to be made of camera swings and tilts, a feature which will be very useful to architectural and commercial photographers.

To increase the versatility of the 135mm Wide Field Ektar Lens, the addition of a supplementary Kodak Telek Lens 3—is suggested, but as an emergency procedure only. This Telek Lens is comparatively inexpensive and, in combination with the Ektar Lens recommended above, will result in a total focal length of about 9 inches. This focal length, when used with a 4 x 5-inch film, provides an emergency means for making portraits with suitable perspective; it also provides the news photographer with low-power telephoto effects for outdoor sports events, but its definition for this purpose will be acceptable only if a comparatively small aperture is used. It should be noted that the engraved *f* values do not apply for the combination.

Versatile Lens Equipment. The following lenses for a 4 x 5-inch camera will satisfactorily meet the demands of nearly every situation encountered in professional photography.

For General Use: Kodak Ektar Lens 152mm *f*/4.5. If increased angular coverage is desired and decreased corner definition can be tolerated, the Kodak Ektar Lens, 127mm *f*/4.7 can be substituted. This latter lens is suggested for general press photography.

For Wide-Angle Effects Allowing Full Use of Swings: Kodak Wide Field Ektar Lens, 135mm *f*/6.3.

For Portraiture or Low-Power Telephoto Effects: Kodak Commercial Ektar Lens 8½-inch or 10-inch *f*/6.3 if the bellows permits.

Other substitutions in this line-up can be made, of course, if the compromises involved can be tolerated. For example, if economy is a factor, the 10-inch Kodak Commercial Ektar Lens can be replaced with the Kodak Ektar Lens, 8-inch *f*/7.7, an excellent copying lens.

WORKING DISTANCES

Professional photographers are increasingly concerned with the problem of the minimum working space needed to take a particular kind of picture.

The following chart was compiled to help provide the answer. It should be noted, however, that the working distances are not necessarily recommended distances, but rather are minimum distances from which the work can be done. This is particularly true for group photographs taken with one of the Kodak Wide Field Ektar Lenses where a minimum camera-to-subject distance can mean objectionable subject distortion at the edges of the picture.

Film Size (in inches)	Type of Portrait	Suggested Focal Length*	Minimum Working Space** (in feet)	Suggested Kodak Lens
4 x 5	Head and Shoulders	8½″ to 10″	15	Commercial Ektar, 10-inch f/6.3
	Full-Length Figure	6″	16	Ektar, 152 f/4.5
	Groups 10 Feet Wide	100mm	18	Wide Field Ektar, 100mm f/6.3
5 x 7	Head and Shoulders	12″ to 14″	15	Portrait, 12-inch f/6.3
	Full-Length Figure	8″ to 8½″	15	Commercial Ektar, 8½-inch f/6.3
	Groups 10 Feet Wide	135mm	16	Wide Field Ektar, 135mm f/6.3
8 x 10	Head and Shoulders	14″ to 16″	15	Portrait, 16-inch f/4.5
	Full-Length Figure	12″	17	Commercial Ektar, 12-inch f/6.3
	Groups 10 Feet Wide	190mm	18	Wide Field Ektar, 190mm f/6.3

*Not using camera swings.
**These values assume the image occupies 90 percent of the negative dimension and includes an allowance of about 7 feet for lights, background, and camera working room.

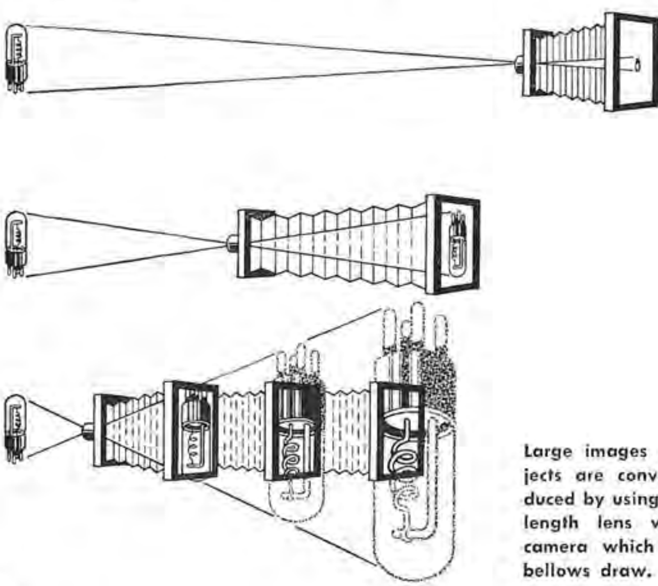
If there is ample working distance, many photographers find that a lens of a 12-inch focal length is the most satisfactory for all-around studio work. A 12-inch lens, such as the Kodak Commercial Etkar Lens, 12-inch *f*/6.3, can be used to photograph groups on 8 by 10-inch film. It also provides good perspective for portraits taken on 5 by 7-inch or "split" 5 by 7-inch film.

SMALL-OBJECT PHOTOGRAPHY

Small-object photography at very low magnifications (less than 25×) is termed "photomacrography." Amateur photographers, using lens attachments such as the Kodak Portra Lenses, cannot achieve more than 1-to-1 image sizes. However, the professional photographer using lenses of short focal length with a view camera having a long bellows draw can actually magnify images over life size.

It may seem strange to some photographers that, for example, a 4-inch lens or one of even shorter focal length can be used satisfactorily to cover an 8 x 10-inch sheet of film. The reason is as follows: A lens has a fixed angular covering power, which means that the area of good definition produced at the film plane is a circle described by a given angle subtended at the lens. The size of the circle depends on the image distance. When the image moves farther behind the lens, as it does when the subject approaches the lens, the circle of good definition increases, but the angular coverage does not change.

When the subject has moved up to twice the focal length away from the lens, the image is two focal lengths behind it. In the case of a 4-inch lens as used for a 2¼ x 3¼-inch camera, when the subject is 8 inches in front of the lens, the image is 8 inches behind it. In such a case, the lens will cover a 4½ x 6½-inch area, since this comes within the angle of good definition of the lens.



Large images of small objects are conveniently produced by using a short focal length lens with a view camera which has a long bellows draw.

Magnification

Since the final magnification is dependent upon the lens and camera bellows extension only, it can be calculated simply from this formula:

$$M = \frac{v-f}{f}$$

where "v" is the lens-to-film distance, and "*f*" the focal length of the lens. Thus, with a 2-inch lens and a 42-inch bellows draw, a magnification of 20× is obtained.

Most camera and enlarger lenses, such as the Kodak Enlarging Ektar Lenses and the Kodak Enlarging Ektanon Lenses, when used in this technique, should be placed on the camera "backward," that is, with their front elements facing the film which is now farther away than the subject. This can be done conveniently only with a camera which has a lens board. This position provides the best definition, since the optical conditions are more nearly like those for which the lenses were designed. Another lens which retains its corrections to a high degree when used for extreme close-ups is the Kodak Ektar Lens, 8-inch *f*/7.7. Lenses with symmetrical elements, or lenses designed specifically for this use, such as the Bausch and Lomb Micro-Tessar Lenses, are exceptions and should be mounted in the normal manner.

Picture Taking At a 1-to-1 Ratio. When the image size on the ground glass is approximately the same as the object size, focusing cannot be done by moving the lens. The customary technique for overcoming any difficulty in focusing is as follows: The lens-to-film distance ("v") should be set for the required magnification and, if possible, locked in position. It is usually preferable not to alter this setting and to obtain the final focus by *moving the subject.* This is possible when a movable or focusing stage is employed and is particularly important when working at approximately 1 to 1. A mirror on the wall behind the ground glass will be helpful in focusing.

If it is not feasible to move the subject, the camera should be focused by racking the entire camera-back forward or backward as necessary, leaving the lens stationary with respect to the subject.

The exposure determination should, of course, take into consideration the bellows-extension factor. In extending the bellows to make extreme close-ups, the image distance becomes appreciably greater than the focal length; hence the *effective* *f*-number will be higher than indicated. The Effective Aperture Computer in the Kodak Master Photoguide is useful in determining exposure under these conditions. Information on photomacrography can be found in the Kodak Industrial Data Book "Photography Through The Microscope."

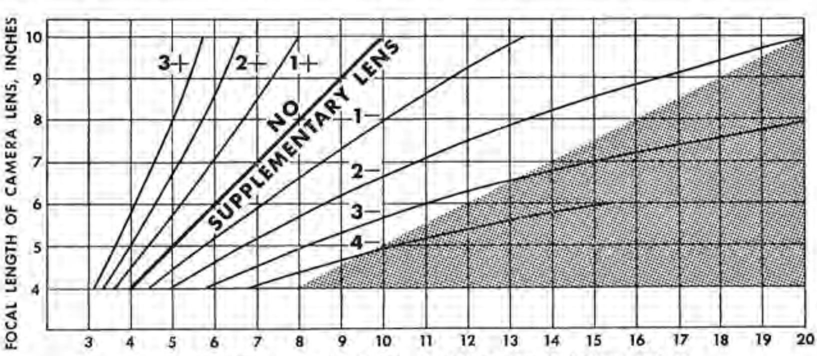
ACCESSORY LENS ATTACHMENTS

Kodak Portra Lenses are simple, positive meniscus lenses that effectively reduce the focal length of the camera lens with which they are used. Because in most miniature and roll-film cameras the initial lens-to-film distance cannot be reduced because of physical reasons, Portra Lenses are used primarily for effectively reducing the normal lens-to-subject distances for close-up work. This application is primarily used by amateur photographers as a technique for making close-ups of flowers and similar subjects. It is usually desirable to work with the main lens system somewhat stopped down to increase both sharpness and depth of field.

Kodak Telek Lenses are simple, negative meniscus lenses that effectively increase the focal length of the camera lens with which they are used in front of and next to for simulating telephoto effects. Because Telek Lenses increase the focal length, they can be used only with cameras employing extension tubes or with bellows-type view cameras to extend the lens-to-film distance. Focusing must be done on the ground glass.

Two factors should be noted in the use of Telek Lenses. First, it is impracticable to use a combination whose focal length is longer than the maximum camera-bellows extension. In fact, the combined focal length should be somewhat shorter than the bellows length to permit some focusing movement. Secondly, a supplementary lens introduces some slight aberrations (unsharpness) which increase with aperture and focal length of the camera lens and with the power of the supplementary lens.

*Table of combined focal lengths. Combinations in shaded area require more than double bellows extension. Combined focal length should be shorter than bellows length.



The important factor to note about both Telek and Portra Lenses is that they change only the focal length and *not* the angular coverage of lenses with which they are used in combination. For example, using a Portra Lens on a view camera means only that the focal plane is closer to the lens than it would normally be without the Portra Lens; it *does not mean that Portra Lenses can be used to improve wide-angle effects*, because wide-angle effects can be obtained only with a lens of shorter-than-normal focal length and increased angular covering power. However, if a camera lens has angular coverage that exceeds the film area, then the addition of a Portra Lens can be used to shorten the camera-lens focal length and permit moving the lens closer to the film, thereby increasing the angular coverage for that film. But, to use a Portra Lens on a 6-inch or shorter lens would mean that the focal length of the combination would be so short for a 4 x 5-inch film that the image would appear on the ground glass only in a small circle in the middle of the field.

Although supplementary lenses are not substitutes for fine photographic objectives, they do provide a high degree of flexibility available in no other manner. When used within their limitations, they often meet professional standards.

Additional information on Telek and Portra Lenses is found in the Kodak Lenses, Shutters, and Portra Lenses Data Book.

Kodak Combination Lens Attachments are available for use on practically all lenses having mounts measuring from ¾ to 2⅝ inches in diameter for which slip-on mounts are feasible. The design of these attachments permits their use either as a single unit, such as a filter, or as a combination of units, such as a filter and a Pola-Screen.

Kodak and Wratten Filters, Kodak Supplementary Lenses, Kodak Pictorial and Kodak Close-up Diffusion Disks, Kodak Pola-Screens, and Kodak Step-up Rings are available for use with the Kodak Combination Lens Attachments. Complete information can be obtained from your Kodak dealer.

Kodak Retaining Ring makes it possible to assemble two filters, or a filter with a supplementary lens. The Kodak Retaining Ring holds one disk in the Kodak Adapter Ring, and either the Kodak Adapter Ring Insert or Kodak Lens Hood holds the second disk. Kodak Combination Lens Attachments can be purchased separately, as needed.

Made with a Kodak Portrait Lens, f/4.5.

View-Camera Adjustments

• The various adjustments—swings, slides, rises—which it is possible to make with a versatile view camera are often regarded by photographers as complex. As a consequence, view cameras are often adjusted largely by trial and error. Yet the adjustments are not so difficult if the *principles* are understood and a logical system is adopted as a routine camera technique.

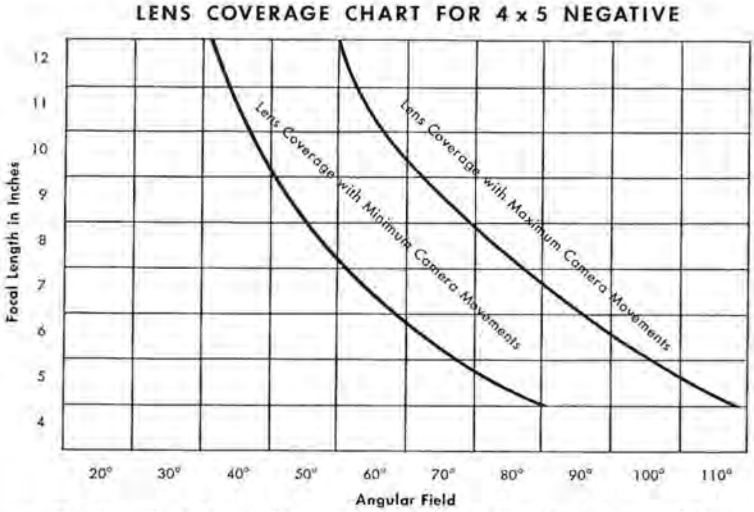
In brief, the purpose of view-camera adjustments is as follows:
The Swing Back (horizontal and vertical) is used (a) to rectify perspective distortion or (b) to adjust the focal plane to the depth requirements of the subject.
The tilting lens (horizontal and vertical) positions the lens so that the plane of sharp focus coincides with the principal plane of the subject.
The rising and falling front (and/or) *horizontal slide* secures a correct lens and film relationship for cases when the subject is not on the camera axis.
The rotating back is a very convenient means of rotating the film as desired to fit the placement of the subject without the necessity of tilting either the camera or subject.

LENS COVERAGE

In the first place, it is important to realize that the extent to which the adjustments of a camera, such as the Kodak Master View Camera 4 x 5, can be used and still give complete negative coverage is dependent upon the lens coverage. As discussed previously, the ability of a lens to cover the negative size at the extremes of the camera movements is, in turn, dependent upon its focal length *and* the angular field covered by the lens.

Because the 4 x 5-inch is a very widely used film size among professional photographers, a lens coverage chart for this size film only is given for purposes of illustration. Obviously, the same principles apply to other film sizes and lens combinations. Recommendations on these other combinations are given in the data sheets found on pages 51 to 64.

This chart has one curve which indicates the focal length and angular field of lenses that give complete coverage. It must be remembered, however, that this curve indicates the requirements when a maximum camera-front rise and maximum horizontal slide are em-



This chart should be used in conjunction with the data sheet on page 54.

ployed *at the same time.* Since this is a maximum camera movement which is seldom necessary, a lens of shorter focal length and/or smaller angular field will have ample coverage except for extreme cases with particular regard to the corners of the image.

The remaining curve on the chart gives the focal length and angular field of lenses which give good coverage when camera movements are *not* used. Inasmuch as this curve represents the minimum, a lens giving adequate coverage for average camera movements can be selected from between the two limits.

As an example, an 8-inch lens with a 69-degree angle will give complete coverage at maximum camera movements; however, an 8-inch lens with a 58-degree angle will meet the coverage requirements normally encountered. A 6-inch lens with a 72-degree angle will also give about the same coverage as the latter lens.

In summary, therefore, *the first point to ascertain is that the lens selected will adequately cover the film, even at the corners, for whatever camera adjustment is desired.*

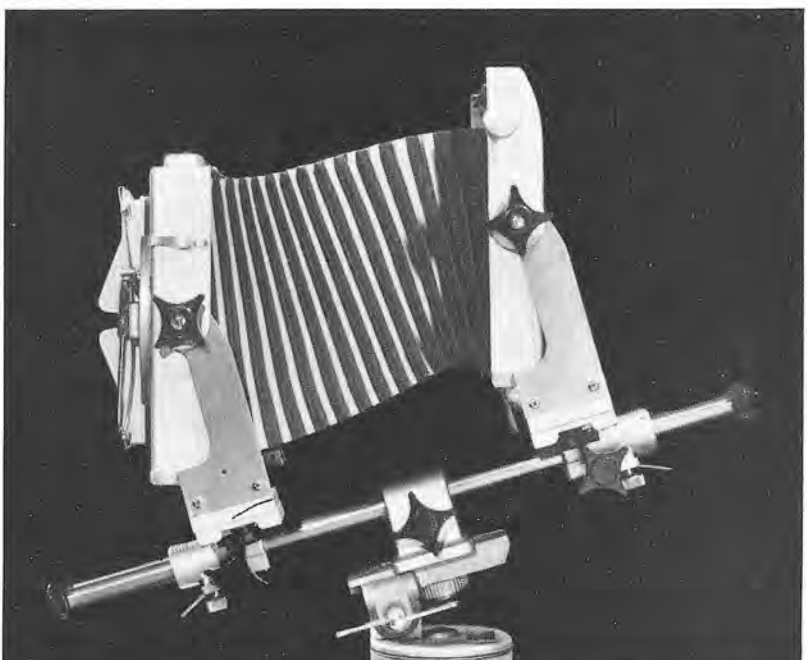
(Opposite.) These illustrations were taken with a Kodak Wide Field Ektar Lens, 100mm f/6.3, on an 8 by 10-inch film. Lens apertures used were f/6.3 for the one at the top, f/32 for the one at the bottom. Note that the circle of illumination does not increase appreciably after stopping down, but the area of useful sharpness does increase.

WORKING PROCEDURE

The actual steps for setting up the camera should be taken in the following order: After the desired viewpoint is selected, the groundglass image should be brought into approximate focus. This much, which is routine for all photographers, should be accomplished with all camera adjustments "zeroed," and with the lens opened to its maximum aperture. The four final steps are:

1. Swing and/or tilt the camera back to control the line relationships of the subject. (To eliminate perspective distortion.)
2. Swing and/or tilt the lens until the plane of sharpest focus coincides with the principal plane of the subject.
3. Readjust the camera focus if necessary.
4. Stop down the lens until the desired depth of field has been obtained.

In simple terms, this four-step procedure will serve as a guide to the procedure for any subject encountered. However, there are refinements concerned with any photographic technique, and the following paragraphs are presented to help clarify these procedures.



The final camera position from which the lower right-hand picture on page 33 was taken.

1. Camera zeroed, verticals converging.

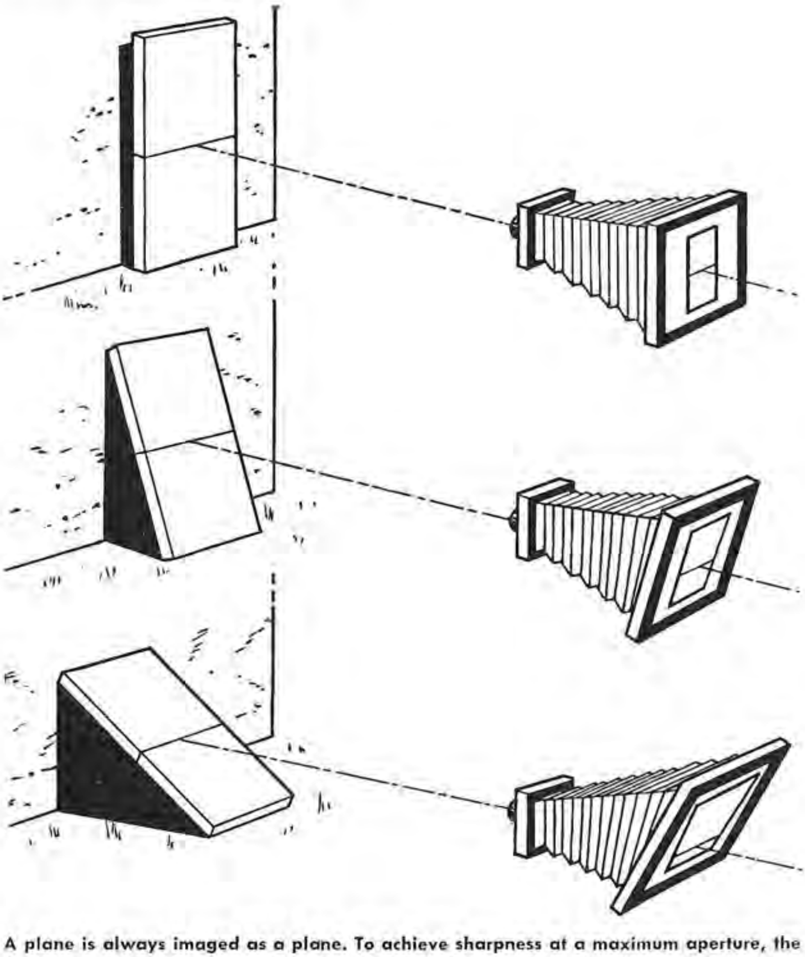
2. Back vertical, verticals parallel.

3. Lens tilted parallel to back.

4. Lens at f/32, depth satisfactory.

THE SWING BACK

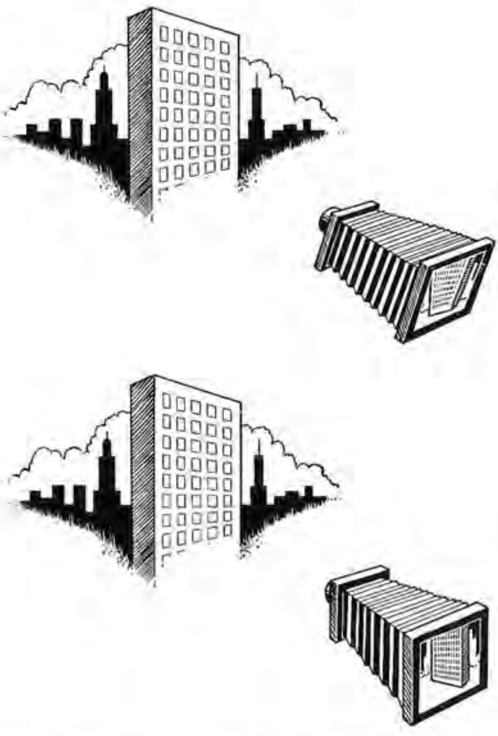
The principal purpose of the horizontal and vertical swing movements of the camera back is to position the film plane so that the "drawing" of the image on the ground glass will appear as desired by the photographer. This may be a correction of converging or diverging lines, or it may be a deliberate perspective distortion to fit the mood of the picture. The fundamental point to remember is that the *image shape is similar to the subject shape as long as the camera back is parallel to the subject.*



A plane is always imaged as a plane. To achieve sharpness at a maximum aperture, the back must be tilted at an angle from the vertical opposite to the plane of the subject. Tilting the lens is preferable to swinging the back to achieve depth.

Correction of Vertical Lines. The classic example to show the use of the vertical-back swing is in architectural photography. In photographing a tall building, the problem is, of course, to keep the vertical sides of the building parallel, rather than "wedged," even though the camera is looking upward to include the top of the building. If the film is kept vertical, the image of any vertical rectangle in the subject, such as the outline of the building, which is parallel to the film plane will have an image in the film plane which is a similar rectangle.

From a practical standpoint, the film can be kept parallel to the front of the building in either of two ways. First, the lens itself may be raised by means of a rising front, while the camera bed is kept horizontal and the back vertical. Secondly, the customary solution to the problem is to tilt the whole camera upward and adjust the swing back to restore the film to its original vertical position.



Note the difference in the inverted image of the building on the camera ground glass when the back is tilted and when the back is parallel to the subject plane. The rising-front and tilting-lens adjustments are also generally used in this situation.

Another case which is optically similar to the photography of architecture is the photography of furniture and other relatively small objects from a viewpoint slightly above them. Here, again, the film plane must be kept vertical; otherwise, rectangular vertical subjects will appear smaller at the bottom than at the top. Since the adjustment possible with the falling front may not be as much as needed, it is usual to tip the camera bed down and swing the back vertically so that it is parallel to the subject plane. The lens is usually tilted to provide sharp focus over the entire picture.

The picture at the left shows the subject taken with the camera tilted down and without the camera back (film plane) parallel to the subject. The diverging lines of the table legs are quite apparent. For the picture at the right, the back has been tilted to be parallel with the subject plane. Note the resulting correction of diverging lines.

Correction of Horizontal Lines. It sometimes happens that a rectangular subject must be photographed without its front surface being at right angles to the camera axis, but the picture must show the surface as a rectangle. This could not be done unless the camera back was horizontally adjusted. For example, a photograph of a store window is wanted from directly in front of it, but a post on the sidewalk interferes with this viewpoint. The camera must therefore be placed slightly to one side. If the swing back is adjusted horizontally so as to be parallel to the store front, a rectangular image of the window will be obtained and will appear almost as though it had been photographed directly from the front. Throughout this discussion, it should be remembered that these view-camera adjustments can be made satisfactorily only if the covering power of the lens permits.

Another such case is the photography of a rectangular cabinet to show its front, top, and one side. If desired, the front may be rendered as a rectangle by adjusting the swing back parallel to it. The fundamental fact in such use of the swing back can be repeated to advantage: *When the film plane is parallel to the subject plane, the image shape is similar to the subject shape.* Swinging the lens does not alter the image shape; it merely helps to provide sharp focus.

At the left, with the camera adjustments zeroed, the horizontal lines are objectionably convergent. If a combination of both the horizontal and vertical back adjustments is used so the film is parallel to the subject, the subject is pictured as shown at the right.

Depth of Field with the Swing Back. Although the *primary* function of the swing back is to control the line relationships of the subject, it has a secondary function which is commonly referred to as "increasing the depth of field." This secondary function to obtain sharp focus can be utilized only when the control of line relationships can be sacrificed, particularly when the subject has considerable depth and is at an angle to the camera. Furthermore, the back should be swung for this purpose only if the camera does not have a tilting lens board or after the lens has first been tilted as far as permissible. When this is the case, the swing of the camera back must be such that the farthest

The upper left picture shows a subject of considerable depth photographed with the camera back in a zeroed position. Even with the lens stopped down, it would be impossible to have all parts of the subject in sharp focus. To increase the depth of field, the camera back was swung so that the part of the subject farthest from the camera was recorded on the side of the film nearest the subject. Parallelism of horizontal subject lines is not a problem here, but if it were, the choice would have to be made between convergence of horizontal subject lines and increase in depth of field. Both pictures of the table were taken at the same lens opening.

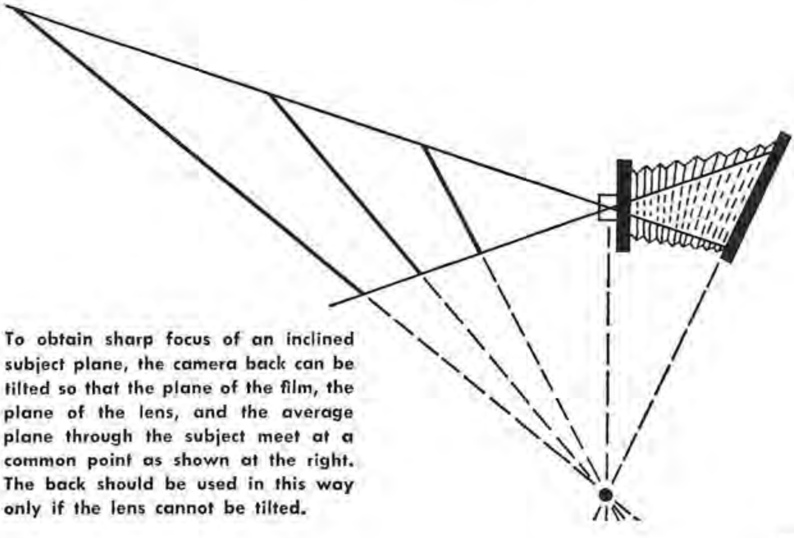
point in the subject will be recorded on the nearest point on the film.

Let us examine more fully the technique of increasing the depth of field with the swing back. In general, the principle to follow is this: *The swing back must be tilted at an angle from the vertical opposite from the direction by which the subject tilts from the vertical.*

In order to understand just where in the subject region sharpest focus can be obtained, consider how a lens forms an image of a plane. The image of any plane is always a plane. If the subject plane is inclined to the lens axis, the image plane is inclined also, as shown below. Thus, when a subject that lies approximately in a plane is photographed, the lower part being close to the lens, the lower part of the camera back should also be close to the lens to secure greatest sharpness over the entire subject area.

An example is the photographing of very large groups, say several hundred people, who may be in a number of rows in a bleacher-type seating arrangement. The people at the bottom are very close to the camera. Those at the top are very far away from the camera. The swing back can secure sharp focus on all the faces, even when a large lens stop must be used if the bottom of the film is nearest to the lens. However, it should be remembered that, if possible, it would be preferable in this case to obtain the desired depth by tilting the lens.

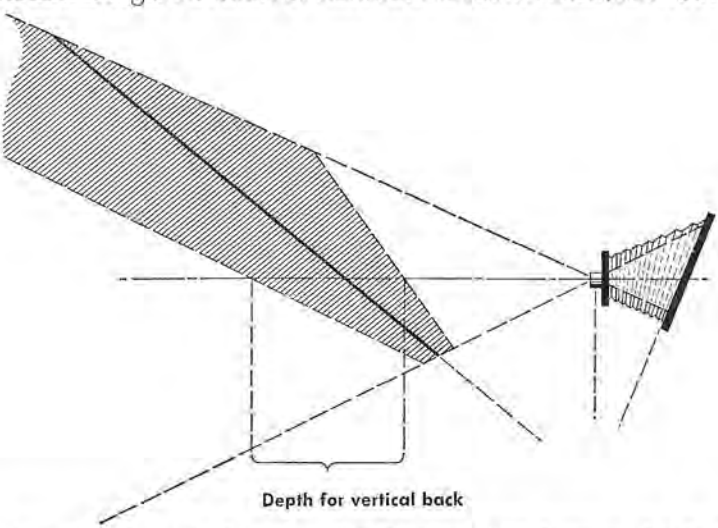
Another example is a dining table with dishes, food, and so forth. Again, the top of the back should be tipped away from the lens.



To obtain sharp focus of an inclined subject plane, the camera back can be tilted so that the plane of the film, the plane of the lens, and the average plane through the subject meet at a common point as shown at the right. The back should be used in this way only if the lens cannot be tilted.

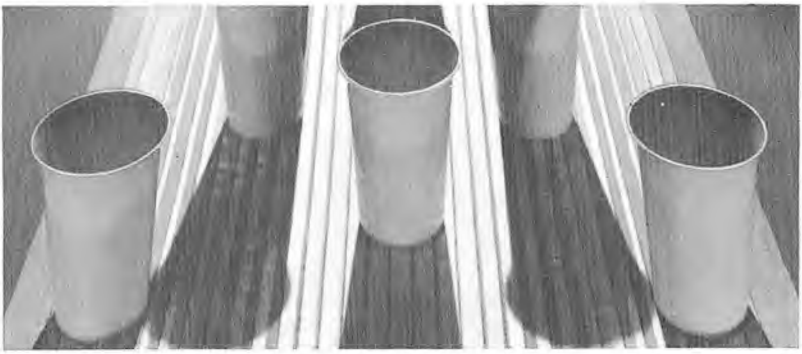
For photographing such subjects, the camera is adjusted in the following way: Sharp focus is obtained in the center of the ground glass. The camera back is then tipped, bringing the top away from the lens, while refocusing for the center of the ground glass if necessary. When sharp focus is observed for the close part of the subject, that is, the part from which the image falls on the top of the ground glass, it will probably be found that the farther parts of the subject are also about in focus. Adjustment must be made with more care for the near parts of the subject than the far parts, because the depth of the near part is very small compared to that of the far part. The depth of field of the tilted back assumes a rather peculiar funnel-shaped envelope which by trial or by skillful adjustment of the camera can be made to cover many subjects and accomplish the seeming miracle of "the lens wide open and everything sharp." By using both the swing back and the side swing, this envelope may be inclined or twisted in any direction. It should be noted, however, that if any objects come within the angle of the lens in areas outside the envelope they will not be in sharp focus. In such subjects, there would be no advantage in swinging the back.

Drawn below, the funnel-shaped area represents in a diagrammatic way the depth of field for a tilted swing back. The depth for a tilted swing back cannot be readily computed; in fact, each lens type may differ in this regard because of difference in barrel cutoff, and so forth.

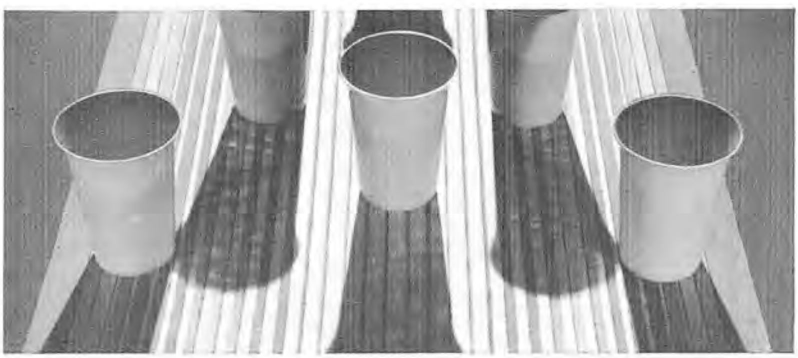


This shows the difference in the placement of the area of field sharpness when the back is vertical (dotted area on horizontal line) and when it is inclined (shaded area).

Some perspective distortion results from use of the swing back for increasing depth of field. Foreground objects appear larger than they should. In addition to the change in size, objects are also changed in shape. A sphere which would ordinarily be rendered as a circle is rendered as an ellipse when the swing back is used.



Above: The camera back was vertical and parallel to the glasses. Note subject distortions. Below: The camera back was zeroed and the lens tilted forward to obtain sharpness. In both cases, the camera is looking down at the subject at about a 45° angle.



The distortion can be rectified to a certain extent in projection printing, in the sense that a print can be made almost as though the camera back had been vertical. One arrangement by which this can be done is as follows: The enlarger lens is placed at approximately the same distance from the negative as the camera lens was, which means that the enlarger lens must be shorter in focal length than the camera lens. The paper holder is tilted by about the same angle as the swing back was, or at least to such an angle that the shape and size of the objects appear to be correct.

THE TILTING LENS

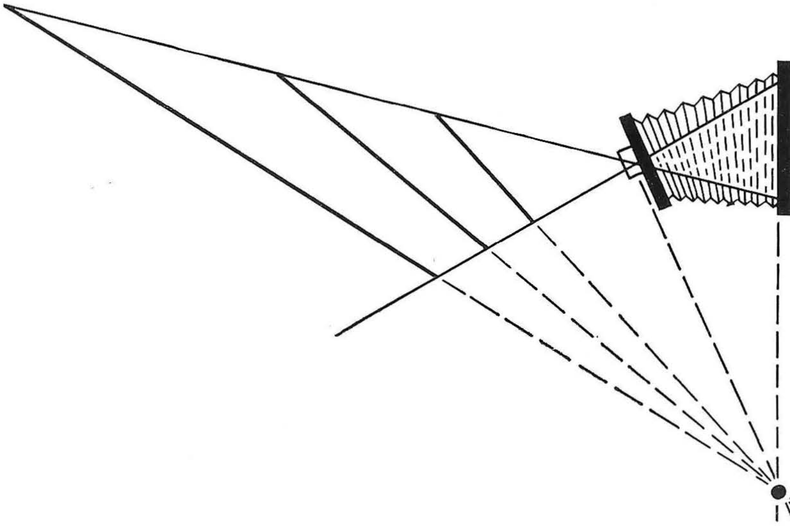
The function of the swinging, tilting camera front is to swing the lens to place the plane of sharp focus in the correct relationship to the subject. Good photographic lenses are constructed to give a sharp image of a subject plane in a flat field, and for every subject plane there is a corresponding sharp image plane. The angle of the lens to produce sharp focus (in relation to subject and film) is shown below.

Some view cameras are not so versatile as the Kodak Master View Camera. For those cameras on which the lens board will not swing on a horizontal axis, the effect produced by a swinging lens can be produced in another way by adjusting the camera as follows:

(a) Slide the lens board laterally to one side.

(b) Aim the camera so that the subject image is centered on the ground glass.

(c) Swing the camera back horizontally so that the ground glass is at right angles to the camera-subject axis.



When tilting the lens, the best placement of area of sharpness is obtained when the plane of the film, the plane of the lens, and the average plane through the subject meet at a common point. Compare this diagram with the one on page 39. If the photographer has a choice of tilting the lens or tilting the back to obtain satisfactory focus, the lens adjustment is to be preferred because it helps prevent subject distortion. Remember that with extreme camera adjustments, the lens must have a coverage greater than normal.

The accompanying diagram can be used to envision the preceding and the following situations depending on whether it is regarded, respectively, as a top or side view of the camera.

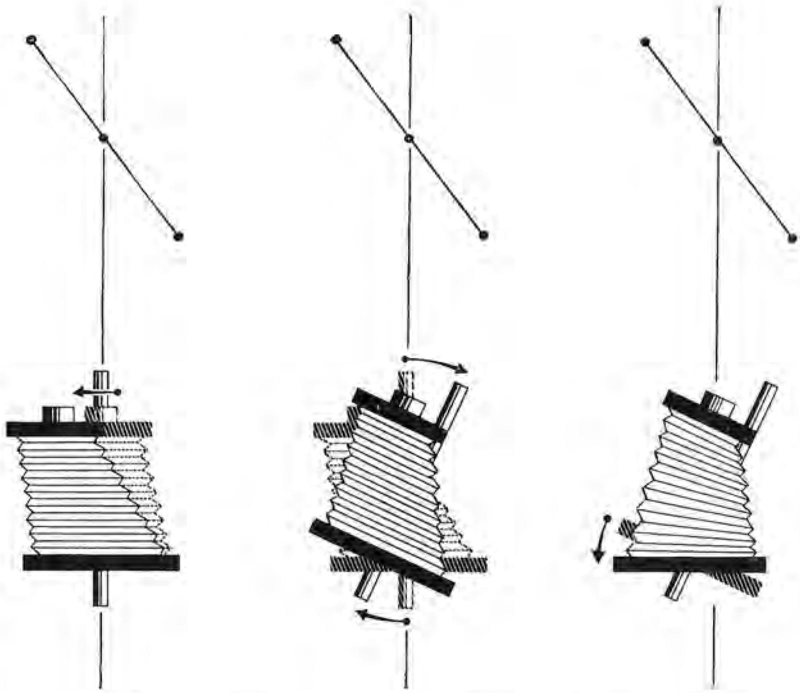
If the camera lens board will not tilt vertically, the effect produced by a lens board which is tilted forward can be duplicated as follows:

(a) Aim the camera down more than necessary from the desired position when all adjustments are "zeroed."

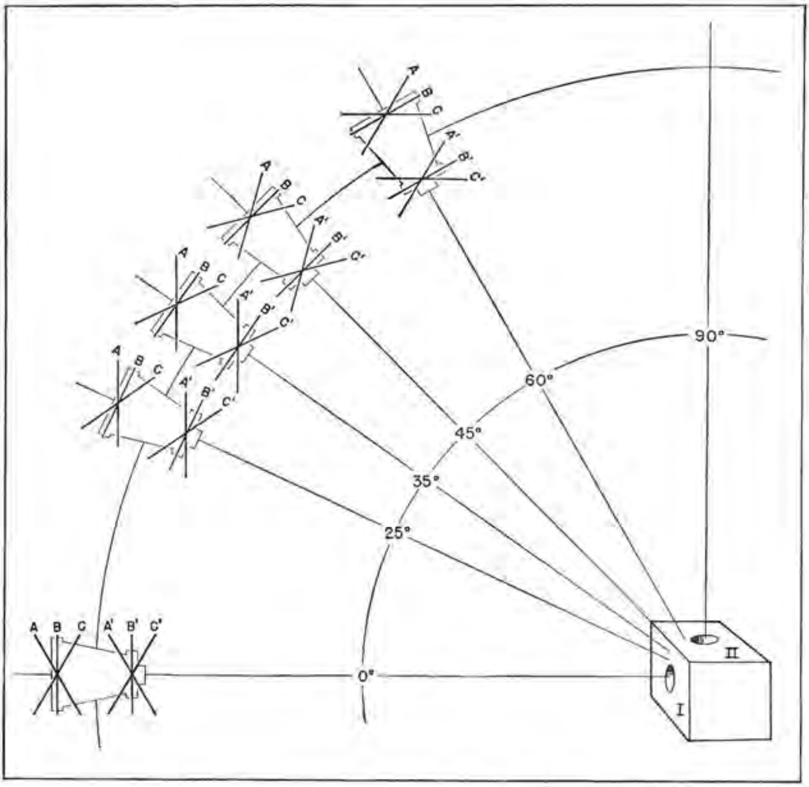
(b) Raise the lens board until the subject image is repositioned as desired on the ground glass.

(c) Return the swing back to a vertical position.

This particular camera position will be found very useful in banquet photography or wherever vertical lines must be kept parallel yet the principal flat plane of sharp focus extends from near to the camera to a considerable distance away.



The effect of a swinging or tilting lens board can be duplicated on a camera without these adjustments if the sliding-rising front and the swinging-tilting back adjustments are available. This diagram can be used to envision the simulated adjustments of a swinging (to the side) and tilting (forward) lens by regarding it as a top or side view.



• This diagram and table serve as an approximate guide for adjusting the back and lens board of a versatile view camera for several different camera viewpoints. Note that the subject contains both horizontal and vertical lines as well as a circular hole in each of the principal planes nearest the camera. The problem is threefold: In each camera position it is desirable, of course, to photograph the subject so that the lines are parallel, the shape of the holes is undistorted, and as great a field depth as possible is obtained at the maximum lens aperture.

As the table indicates, the lens position can be determined only after deciding which of the two principal subject planes is the more important.

It should also be noted that in many instances the eye will tolerate subject distortion of diverging lines with less annoyance than it will

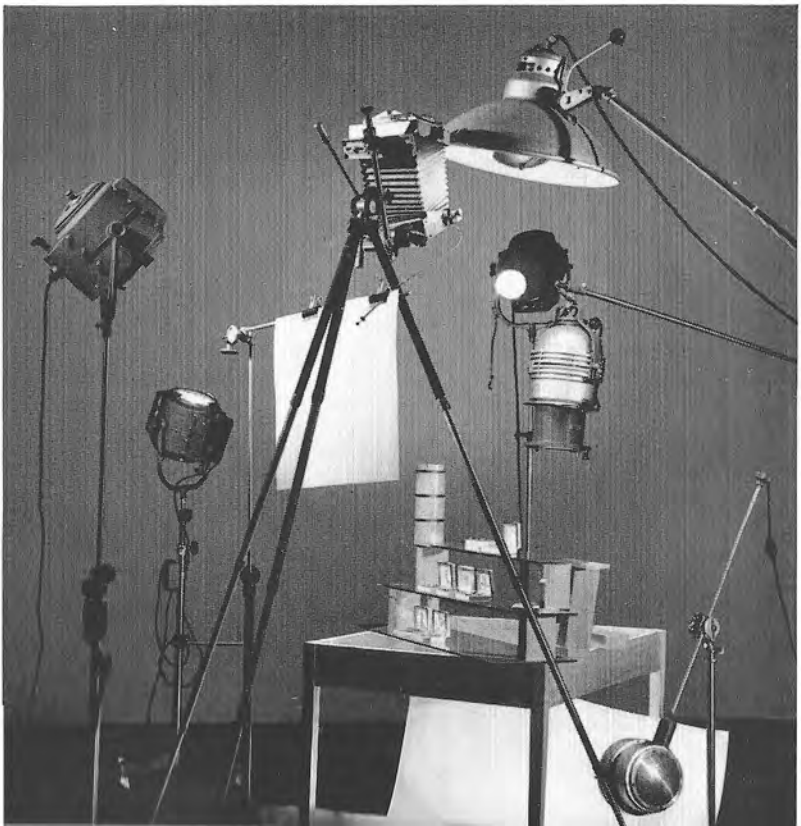
tolerate elongation of the subject obtained when one adheres too strictly to the "vertical back rule." Judgment is obviously needed in making compromises between elongation, parallelism, and the location of the plane of sharp focus. For example, at the 45° camera viewpoint, the camera back is generally at the zeroed B position. This means that parallelism has been sacrificed in favor of less elongation which would result if the back were vertical.

Incidentally, with the back at the 45° B position, the lens is seldom used in a zeroed B' position. In fact, in actual practice, it is usually desirable to swing or tilt the lens in accordance with the requirements of the subject.

Camera Height	Back Positions*	Lens Positions	
		Plane I	Plane II
	A never	—	—
	B always	B'	—
0°	C never	—	—
	A generally	A'	C'
	B occasionally	A' B'	B'
25°	C seldom	—	C'
	A freqently	A' B'	B'
	B occasionally	A'	C'
35°	C seldom	—	C'
	A frequently	A'	A'
	B generally	A' B'	B' C'
45°	C seldom	—	C'
	A seldom	A'	B'
	B frequently	A'	C'
60°	C generally	—	C'

****This diagram represents a side view of the camera-subject relationships. If it is regarded as a top view, the camera back is generally used in B position.***

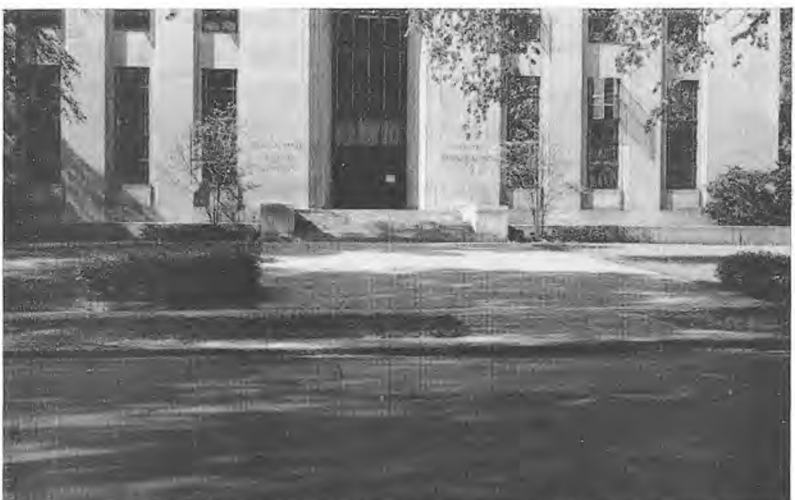
Did you wonder what the camera shown on the cover of this Data Book was photographing? The contorted position was necessary to include the plane illustrated below.

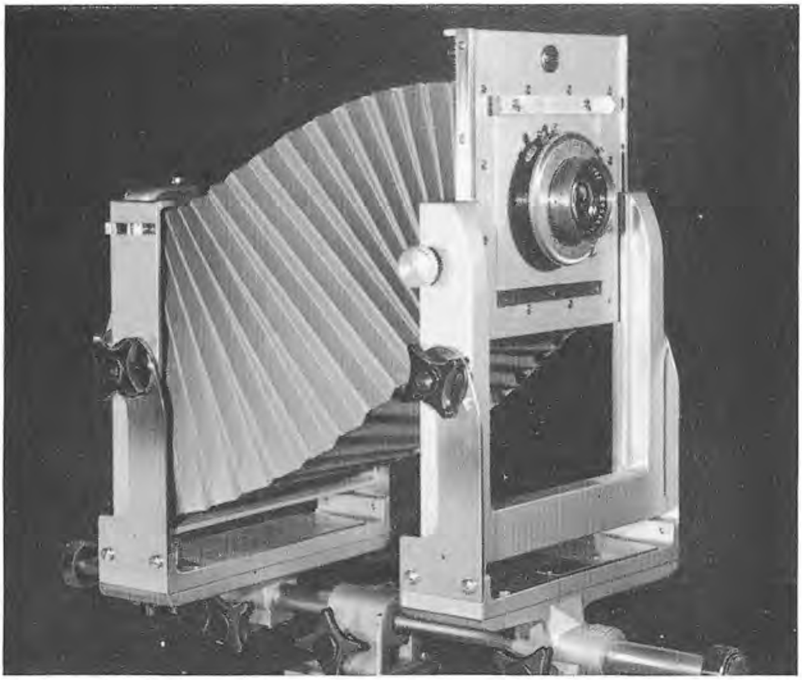


THE RISING AND FALLING FRONT

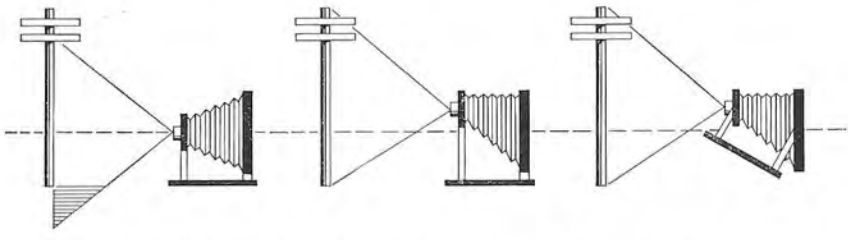
The rising front is used when it is desired to include more of the top of a tall building or some other subject, or when it is necessary to eliminate excessive foreground, without tipping the camera. In the case of a hand camera, the sliding front is used as a rising front when the camera is in a horizontal position. The rising-falling front is simply another means of controlling the subject, lens, and film relationships.

By use of the rising or falling front, the lens can be moved above or below the optical axis without disturbing the parallel relationship between the subject plane and film plane. If the camera is above the subject, the same results can be obtained by lowering the front. Since the adjustment possible with the falling front is limited, however, the camera bed is usually tilted down, and the camera front and back are tilted to a position parallel to the subject plane.





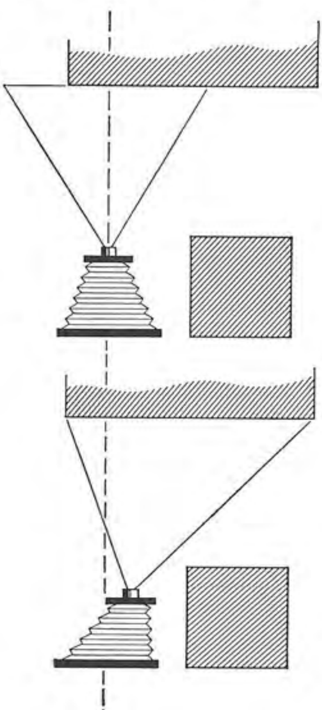
The camera in this position was used to take the picture at the bottom of page 47. The rising front is used to eliminate part of the foreground without changing the parallelism.

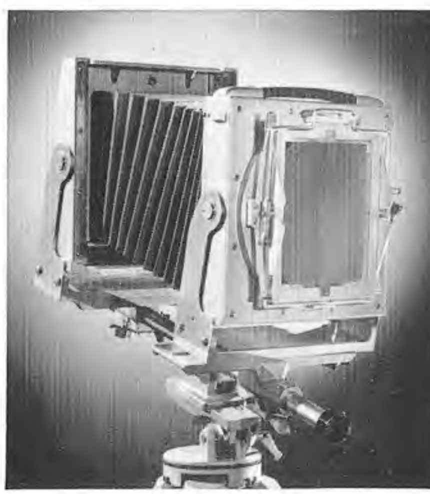


The diagram at the left indicates the subject coverage with the camera in a normal position. The center diagram shows the camera with the front raised to give complete subject coverage. The diagram at the right illustrates that the same result can be obtained if the camera is tilted up and the camera front and back are kept parallel to the subject by means of the tilting adjustments.

Similar results are accomplished horizontally by using the horizontal slide of the front and rear carriages, but in this case, instead of moving only the lens, the lens and back are moved in opposite directions to provide greater movement. This is shown on the next page.

The picture at the left shows subject coverage with the camera front and back in a normal position. An obstruction, shown in the diagram below, prevents centering the camera.



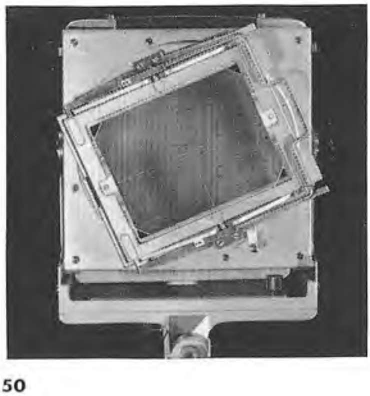


With the camera positioned as shown in the illustration above, the picture at the top right conveys the impression of a central camera position without moving the tripod.

OVER

THE ROTATING BACK

The principal use of the rotating back is to locate the film in the correct position to provide subject coverage, both horizontal and vertical. It is often used to make slight corrections of image alignment on the film. It saves tipping the camera and thus can be used to orient the subject in any position on the film intermediate to exact horizontal or vertical positions.



Illustrated here is a common use of the rotating back—to impart individuality to an ordinary subject through the use of an unusual camera angle. This camera adjustment is also very useful in portraiture where it is much more convenient to rotate the back slightly than to ask the subject to lean one way or another to improve the composition.

Lens and Shutter Data

• The following pages contain useful data on Kodak lenses and shutters. Lenses of the same basic design are grouped together.

Lens Diagrams: These drawings are schematic presentations of the basic design for each lens or group of lenses. They show the number and approximate arrangement of the various elements. Cemented pairs of elements can be distinguished by the contrasting pattern of the diagonal lines in the drawings. The arrow indicates the direction in which light normally passes through the lens to the light-sensitive material. The two vertical lines indicate the position of the lens diaphragm.

Depth-of-Field Tables: Where lack of space does not permit the listing of the depth of field for all lens stops, the depth of field for the missing *f*-numbers can be estimated by comparing the depth for the next larger and smaller stops.

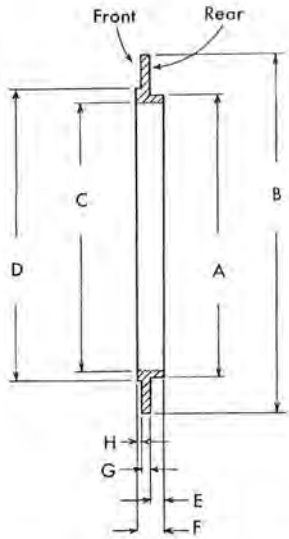
Back Focus: For lenses supplied separately for use in studio, view, press, and reflex cameras, the distance between the rear glass surface of the lens and the focal plane when the lens is focused on infinity, is given. This distance is referred to as the "back focus" of the lens.

Attachment Size: The Series number (VI, VII, etc.) of Kodak Combination Lens Attachments accepted by each lens, as well as the size of the Kodak Adapter Ring required, is listed. Kodak Adapter Rings listed by inches and millimeters are of the slip-on type, and those listed by number are of the screw-in type.

Shutter Data: Shutter speeds and flash synchronization data are given for the shutter in which each lens is supplied. "Class F" and "Class M" refer to photoflash lamps having nominal times-to-peak of 5 and 20 milliseconds, respectively.

ATTACHING LENSES TO VIEW CAMERAS

Removable lens boards, such as those supplied on view, press, or studio cameras, permit lenses for these cameras to be interchanged by the substitution of complete units comprising lens board and lens in shutter or in barrel. A lens is fitted to a lens board by means of a flange similar to that shown in the cross-section drawing at right. A hole is drilled through the center of the lens board, the diameter of the hole corresponding to the outside diameter of the flange shoulder (A in the drawing). The flange shoulder is inserted into this hole and the flange is permanently affixed to the lens board by means of screws through the flange rim. The barrel or shutter in which the lens is mounted is threaded so that it can be screwed into its proper flange. Certain flanges accommodate two or more different lenses. Lenses which fit a common flange may be interchanged by using only one lens board and flange, but it is safer and more convenient to keep each lens in its own lens board.



The table below lists Kodak lenses and gives the dimensions in both inches and millimeters of the proper flange for each lens. Letters in the table correspond to those in the drawing at right.

KODAK LENS (in shutter, unless otherwise indicated)	Flange Dimensions							
	A*	B	C	D	E	F	G	H
Ektar, 101mm f/4.5 Wide Field Ektar, 80mm f/6.3 Synchro Rapid 800 101mm f/4.5 Ektar Lens	1⅜ in. 34.80mm	1.850 in. 47.00mm	1.182 in. 30.10mm 40 Thd. NS		0.156 in. 3.96mm	0.196 in. 4.98mm	0.040 in. 1.02mm	
Ektar, 105mm f/3.7 Ektar, 127mm f/4.7 Ektar, 8-inch f/7.7 Wide Field Ektar, 100mm f/6.3	1½ in. 38.10mm	1.937 in. 49.10mm	1.375 in. 34.90mm 40 Thd. NS		0.156 in. 3.96mm	0.196 in. 4.98mm	0.040 in. 1.02mm	
Ektar, 152mm f/4.5 Wide Field Ektar, 135mm f/6.3	1⅞ in. 47.00mm	2.437 in. 62.00mm	1.750 in. 44.40mm 40 Thd. NS		0.090 in. 2.28mm	0.160 in. 4.06mm	0.070 in. 1.78mm	
Commercial Ektar, 8½-inch f/6.3 in bbl or shutter	2⅛ in. 53.70mm	2.68 in. 68.00mm	1.99 in. 50.50mm 24 Thd. NS	2.23 in. 56.50mm	0.059 in. 1.50mm	0.217 in. 5.50mm	0.079 in. 2.00mm	0.079 in. 2.00mm
Commercial Ektar, 10-inch f/6.3 in bbl or shutter Ektar, 7½-inch f/4.5	2⅝ in. 66.60mm	3.15 in. 80.00mm	2.500 in. 63.40mm 30 Thd. NS	2.60 in. 66.00mm	0.049 in. 1.25mm	0.266 in. 6.75mm	0.079 in. 2.00mm	0.139 in. 3.50mm
Commercial Ektar, 12-inch f/6.3 in bbl or shutter Wide Field Ektar, 190mm f/6.3	2⅞ in. 73.00mm	3.59 in. 91.00mm	2.74 in. 69.69mm 24 Thd. NS	3.04 in. 77.00mm	0.049 in. 1.25mm	0.364 in. 9.25mm	0.079 in. 2.00mm	0.237 in. 6.00mm
Commercial Ektar, 14-inch f/6.3 in shutter Wide Field Ektar, 250mm f/6.3	3⅜ in. 85.50mm	4.28 in. 108.60mm	3.24 in. 82.10mm 30 Thd. NS	3.43 in. 87.00mm	0.218 in. 5.55mm	0.346 in. 8.80mm	0.089 in. 2.25mm	0.039 in. 1.00mm
Commercial Ektar, 14-inch f/6.3 in bbl	3⅜ in. 85 72mm	4.02 in. 102.00mm	3.064 in. 77.78mm 24 Thd. NS	3.41 in. 86.50mm	0.049 in. 1.25mm	0.541 in. 13.75mm	0.079 in. 2.00mm	0.396 in. 10.50mm

*Fits into lens board mounting hole. Fractional inches are given to facilitate selection of standard bit sizes.

CURRENT AND RECENT KODAK LENSES for PRESS, VIEW, and SIMILAR CAMERAS	Adapter Ring Size			Mounting Flange Part Number	
	Series	*Inches*	*Mm*	*Barrel*	*Shutter*
Ektar *f*/4.5, 101mm (Supermatic)	VI	1 5/16	33.		80502
Ektar *f*/4.5, 101mm (Synchro 800)	V	Not needed§			80502
Ektar *f*/3.7, 107mm	VI	1½	38.		HE 23804
Ektar *f*/3.7, 105mm	VI	1½	38.		80503
Ektar *f*/4.7, 127mm	VI	1½	38.		80503
Anastigmat *f*/4.5, 5-in.	VI	1 5/16	33.	HE 3030	
Anastigmat *f*/4.5, 5½-in.	VI	1 9/16	39.5	HE 31896	
Ektar *f*/4.5, 6-in. (152mm)	VII	1¾	44.5		88683
Anastigmat *f*/4.5, 6⅜-in.†	VII	1¾	44.5	HE 3312	
Ektar *f*/4.5, 7½-in.	VIII	2⅛	54.	HE 28592	HE 28592
Anastigmat *f*/4.5, 7½-in.†	VII	2	50.5	HE 3125	
Ektar *f*/5.6, 7½-in. (190mm)	VII	1¾	43.5		
Anastigmat *f*/7.7, 8-in.	VI	1 5/16	33.	HE 31896	HE 24216
Ektar *f*/7.7, 8-in.	VI	1 5/16	33.		80503
Ektar *f*/6.3, 8½-in.†	VII	1¾	44.5	HE 32505	HE 32505
Comm. Ektar *f*/6.3, 8½-in.†	VII	1¾	44.5	HE 32505	HE 32505
Anastigmat *f*/4.5, 8½-in.†	VIII	2⅜	60.	HE 2744	
Ektar *f*/6.3, 10-in.†	VIII	2⅛	54.	HE 28592	HE 28592
Comm. Ektar *f*/6.3, 10-in.†	VIII	2⅛	54.	HE 28592	HE 28592
Anastigmat *f*/4.5, 10-in.†	VIII	2⅝	67.	HE 2458	
Ektar *f*/6.3, 12-in.†	VIII	2½	63.5	HE 28562	
Comm. Ektar *f*/6.3, 12-in.†	VIII	2½	63.5	HE 32442	HE 32442
Ektar *f*/4.5, 12-in.	IX	No. 92 Screw-in		HE 2995	HE 32405
Anastigmat *f*/4.5, 12-in.†	*	—	—	HE 2995	
Eastman Ektar *f*/6.3, 14-in.†	**	—	—	HE 32412	HE 32405
Comm. Ektar *f*/6.3, 14-in.†	IX	No. 91 Screw-in		HE 32412	HE 32405
Wide Field Ektar *f*/6.3, 80mm	VI	No. 27 ‡Screw-in			80502
Wide Field Ektar *f*/6.3, 100mm	VII	Special‡			80503
Wide Field Ektar *f*/6.3, 135mm	VII	Not needed§			88683
Wide Field Ektar *f*/6.3, 190mm	VIII	Not needed§			HE 32442
Wide Field Ektar *f*/6.3, 250mm	IX	Not needed§			HE 32405

*Use 4-in. Kodak Adjustable Filter Holder.
**Use 4-in. Kodak Adjustable Filter Holder.
†In Shutter or Barrel.
‡Kodak Adapter Ring and Kodak Adapter Ring Insert supplied with lens.
§No adapter needed—insert ring supplied with lens.

Kodak Lenses supplied in shutters for use on the Kodak Master View Camera 4x5

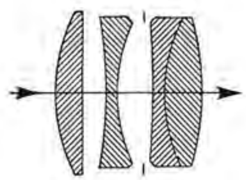
Lens	Shutter	Focal Length		Marked Apertures	Angular Coverage**		Kodak Adapter Ring Size		Kodak Lens Attachment Series	Diameter of Lens Board Mounting Hole	Overall Length of Lens Mount
		in.	*mm*		*Mx. Aper.*	*f/16 or Smaller*	*in.*	*mm*		*in.*	*in.*
Kodak Wide Field Ektar 100mm *f*/6.3	Kodak Flash Supermatic	4	100	*f*/6.3 to *f*/32	75°	85°	screw-in type furnished		VII*	1.500	1.772
Kodak Wide Field Ektar 135mm *f*/6.3	Kodak Flash Supermatic	5 5/16	135	*f*/6.3 to *f*/32	75°	85°	screw-in type furnished		VII*	1.850	1.728
Kodak Wide Field Ektar 190mm *f*/6.3	No. 4 Ilex Acme Synchro	7½	190	*f*/6.3 to *f*/45	75°	85°	screw-in type furnished		VIII*	2.875	2.293
Kodak Wide Field Ektar 250mm *f*/6.3	No. 5 Ilex Univ. Synchro	10	250	*f*/6.3 to *f*/45	75°	85°	screw-in type furnished		. . .	3.368	2.847
Kodak Ektar 152mm *f*/4.5	Kodak Flash Supermatic	6	152	*f*/4.5 to *f*/45	52°	62°	1¾	44.5	VII	1.850	1.455
Kodak Ektar 8-in. *f*/7.7	Kodak Flash Supermatic	8	203	*f*/7.7 to *f*/45	52°	56°	1 5/16	33	VI	1.500	1.250
Kodak Ektar 8½-in. *f*/6.3	No. 3 Ilex Acme Synchro	8½	216	*f*/6.3 to *f*/45	53°	64°	1¾	44.5	VII	2.188	1.750
Kodak Ektar 10-in. *f*/6.3	No. 4 Ilex Acme Synchro	10	254	*f*/6.3 to *f*/45	53°	64°	2⅛	54	VIII	2.625	2.063
Kodak Ektar 12-in. *f*/6.3	No. 4 Ilex Acme Synchro	12	304	*f*/6.3 to *f*/45	53°	64°	2½	63.5	VIII	2.875	2.500

*Filters only.

**See lens coverage chart on page 30.

Lens and Shutter Data:

KODAK EKTAR LENSES
101mm *f*/4.5; 127mm *f*/4.7; 152mm *f*/4.5; 7½-inch *f*/4.5; 12-inch *f*/4.5



These lenses make available to users of small and medium-size press and similar cameras as well as larger view cameras the optical pre-eminence represented by Kodak Ektar Lenses. Their ability to meet most exacting requirements in black-and-white and color photography is well known. All of these lenses are Lumenized.

They produce definition of exceptional quality over the areas they are designed to cover at all apertures and all working distances from infinity to about 3½ feet from the lens. When a shorter lens-to-subject distance is used, it is advisable to stop the lens below maximum aperture, particularly for work demanding critical definition. The 101mm and 127mm lenses are also supplied with metal lens boards for use with the Kodak Flurolite Camera Combination.

Marked Apertures:
101mm lens: *f*/4.5, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32
127mm lens: *f*/4.7, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32
152mm, 7½-in., or 12-in. lens: *f*/4.5, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, *f*/32, and *f*/45

Focal Length, Back Focus, Maximum Recommended Negative Size, and Angle of View (Lens Focused at Infinity):

Focal Length		*Back Focus*	*Maximum Recommended Negative Size*	*Angle of View (Lens Focused at Infinity)*
101mm	4 in.	90 mm	2¼ x 3¼ in.	32° x 45°
127mm	5 in.	113 mm	3¼ x 4¼ in.	36° x 46°
152mm	6 in.	135.2 mm	4 x 5 in.	37° x 45°
7½-inch	7½-in.	169.1 mm	5 x 7 in.	37° x 53°
12-inch	12-in.	271.2 mm	8 x 10 in.	37° x 45°

Infrared Focusing: Lens should be extended from visual focus as follows:
.004 in. (.1 mm) for 101mm lens
.004 in. (.1 mm) for 127mm lens
.03 in. (.76 mm) for 152mm lens
.008 in. (.2mm) for 7½-in. lens
.016 in. (.4mm) for 12-in. lens

Shutters: Kodak Synchro-Rapid 800 (101mm lens): Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400, 1/800 sec, and B. Built-in synchronization for Class F, M, and X. Kodak Flash Supermatic (127mm and 152mm lenses): Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec, T, and B. (No 1/400 sec for 152mm lens). Built-in synchronization for Class F, M, and X. Blade arrester. Kodak Supermatic X (127mm lens): Same features as Flash Supermatic Shutter except synchronized for Class X only. The 7½-inch lens is available in a barrel with iris diaphragm, in an Ilex Universal Shutter (non-flash) or in an Ilex Acme Synchro Shutter. The 12-inch lens is available only in an Ilex Universal Synchro Shutter.

Diameter of Lens-Board Mounting Hole:
101mm lens—35 mm, 1⅜ in.
127mm lens—38 mm, 1½ in.
152mm lens—47 mm, 1⅞ in.
7½-inch lens—66.7mm, 2⅝ in.
12-inch lens—85.6mm, 3⅜ in.

Size of Kodak Combination Lens Attachments:
101mm lens—Series V, no Adapter Ring needed
127mm lens—38 mm, 1½ in., Series VI
152mm lens—44.5 mm, 1¾ in., Series VII
7½-inch lens—54 mm, 2⅛ in., Series VIII
12-inch lens—80 mm, 3 5/32 in. Use Kodak 4-inch Adjustable Filter Holder.

Hyperfocal Distance: Same as near limit of depth of field at infinity. See next page.

Depth of Field: Kodak Ektar Lens, 101mm f/4.5

Distance Focused On—Ft	Approximate Field Size with 2¼ x 3¼″ Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		f/4.5	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/32
INF	32° x 45°	127 to inf	102 to inf	72 to inf	52 to inf	36 to inf	18 to inf
100	56′ x 82′	56 to inf	51 to inf	42 to inf	34 to inf	26 to inf	15 to inf
50	28′ x 41′	36 to 82	34 to 98	29 to 165	25 to inf	21 to inf	13¼ to inf
25	14′ x 20′	21 to 31	20 to 33	18½ to 38	17 to 48	15 to 83	10½ to inf
15	8⅓′ x 12¼′	13½ to 17	13 to 17½	12½ to 19	11¾ to 21	10½ to 26	8⅙ to 92
10	5½′ x 8′	9¼ to 11½	9⅛ to 11	8¾ to 11½	8⅓ to 12½	7¾ to 14	6½ to 23
8	4⅓′ x 6⅓′	7½ to 8½	7⅓ to 8⅔	7⅙ to 9	7 to 9½	6½ to 10¼	5½ to 14½
6	3¼′ x 4⅔′	5¾ to 6½	5⅔ to 6½	5½ to 6½	5⅓ to 6¾	5⅙ to 6⅚	4½ to 8¾
5	2⅔′ x 3⅚′	4¾ to 5¼	4⅚ to 5¼	4⅔ to 5½	4⅔ to 5½	4½ to 5¾	4 to 6¾
4	2′ x 3′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅓	3¾ to 4⅓	3⅔ to 4½	3⅓ to 5
3½	1⅚′ x 2⅔′	3⅓ to 3⅔	3⅓ to 3⅔	3⅓ to 3⅔	3¼ to 3¾	3⅙ to 3⅚	3 to 4¼

The depth is not given for *f*/22. For this opening depth can be estimated by comparison.

Depth of Field: Kodak Ektar Lens, 127mm f/4.7

Distance Focused On—Ft	Approximate Field Size with 3¼ x 4¼″ Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		f/4.7	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/32
INF	36° x 46°	152 to inf	128 to inf	90 to inf	65 to inf	45 to inf	22 to inf
100	65′ x 85′	60 to 292	56 to inf	47 to inf	39 to inf	31 to inf	18 to inf
50	32′ x 42′	37 to 74	36 to 82	32 to 113	28 to inf	24 to inf	15½ to inf
25	16′ x 21′	22 to 30	21 to 31	19½ to 35	18 to 41	16 to 57	11¾ to inf
15	9½′ x 12⅓′	13⅔ to 16½	13⅓ to 17	12¾ to 18	12¼ to 19½	11⅓ to 23	9 to 45
10	6¼′ x 8¼′	9½ to 10¾	9¼ to 10⅚	9 to 11⅙	8⅔ to 11¾	8¼ to 13	7 to 18
8	5′ x 6½′	7⅔ to 8⅓	7½ to 8½	7⅓ to 8¾	7⅙ to 9⅙	6⅚ to 9¾	6 to 12¼
6	3⅔′ x 4¾′	5¾ to 6¼	5¾ to 6¼	5⅔ to 6½	5½ to 6⅔	5⅓ to 6⅚	4⅚ to 8
5	3′ x 3⅚′	4⅚ to 5⅙	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5½	4⅙ to 6⅓
4	2⅓′ x 3′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4⅓	3½ to 4¾
3½	2′ x 2⅔′	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3¼ to 3¾	3 to 4

The depth is not given for *f*/22. For this opening depth can be estimated by comparison.

Depth of Field: Kodak Ektar Lens, 152mm f/4.5

Distance Focused On—Ft	Approximate Field Size with 4 x 5″ Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		f/4.5	*f*/8	*f*/11	*f*/16	*f*/32	*f*/45
INF	37° x 45°	190 to inf	107 to inf	78 to inf	54 to inf	27 to inf	19 to inf
100	66′ x 83′	66 to 209	52 to inf	44 to inf	35 to inf	21 to inf	16 to inf
50	33′ x 41′	40 to 67	34 to 95	30 to 137	26 to inf	18 to inf	13¾ to inf
25	16′ x 20′	22 to 29	20 to 33	19 to 37	17 to 47	13 to inf	10⅚ to inf
15	9⅔′ x 12⅙′	14 to 16¼	13 to 17½	12½ to 18½	11¾ to 21	9¾ to 33	9 to 69
10	6⅓′ x 7⅚′	9½ to 10¾	9⅓ to 11	8⅔ to 11½	8½ to 12½	7⅓ to 15½	6½ to 21
8	5′ x 6¼′	7¾ to 8⅓	7½ to 8⅔	7¼ to 8⅚	7 to 9⅓	6¼ to 11⅓	5¾ to 13⅔
6	3⅔′ x 4½′	5¾ to 6¼	5¾ to 6½	5⅔ to 6½	5⅓ to 7⅓	4⅚ to 7¾	4½ to 8⅔
5	3′ x 3½′	4⅚ to 5⅙	4¾ to 5¼	4¾ to 5⅓	4¾ to 5⅓	4⅓ to 6	4 to 6½
4	2⅓′ x 2⅚′	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3¾ to 4⅓	3⅔ to 4¾	3½ to 5
3½	1⅚′ x 2⅓′	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3 to 4⅙	3 to 4¼

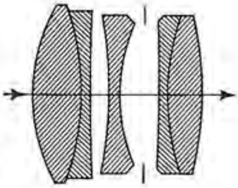
The depth is not given for *f*/5.6 or *f*/22. For these openings depth can be estimated by comparison.

For depth of field information for Kodak Ektar Lens 7½-inch *f*/4.5, use the table on page 60 for the Kodak Wide Field Ektar Lens, 190mm *f*/6.3.

For depth of field information for Kodak Ektar Lens, 12-inch *f*/4.5, use the table on page 63 for the Kodak Commercial Ektar Lens, 12-inch *f*/6.3.

Lens and Shutter Data:

KODAK EKTAR LENS, 105mm *f*/3.7



This lens has been designed for use on small press and view cameras or on the Kodak Flurolite Enlarger A when used as a camera, where excellence of performance and high speed are desired. It has been corrected for all the usual lens aberrations and works equally well at all distance settings from infinity to 3½ feet from the lens. When a shorter lens-to-subject distance is used, it is advisable to stop the lens below maximum aperture, particularly for work demanding critical definition. It is especially suitable for use with Kodak color sheet films. The performance of this lens, like that of other Ektar Lenses, is unsurpassed by any lens of similar type. Like all other Ektar Lenses, this lens is Lumenized. It is supplied in a Kodak Flash Supermatic Shutter.

Marked Apertures: *f*/3.7, *f*/4, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32

Focal Length: 105 mm (4⅛ in.)

Back Focus: 87.5 mm (3 7/16 in.)

Maximum Recommended Negative Size: 2¼ x 3¼ in.

Angle of View: With lens focused at infinity, 31° x 43°

Infrared Focusing: Lens should be extended .004 in. (.1 mm) from visual focus.

Shutter: Kodak Flash Supermatic. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec, T, and B. Built-in synchronization for Class F, M, and X. Blade arrester. Accepts the Kodak Metal Cable Release No. 5.

Diameter of Lens-Board Mounting Hole: 38 mm, 1½ in.

Size of Kodak Combination Lens Attachments: 38 mm, 1½ in., Series VI

Hyperfocal Distance: Same as near limit of depth of field at infinity. See below.

Depth of Field: Kodak Ektar Lens, 105mm *f*/3.7

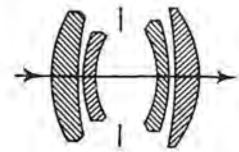
Distance* Focused On—Ft	Approximate Field Size with 2¼ x 3¼" Neg	DEPTH OF FIELD—IN FEET.** Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the focal length, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		f/3.7	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/32
INF	31° x 43°	160 to inf	105 to inf	74 to inf	54 to inf	37 to inf	18⅓ to inf
100	54' x 78'	62 to 266	51 to inf	43 to inf	35 to inf	27 to inf	15⅔ to inf
50	27' x 39'	38 to 73	34 to 96	30 to 154	26 to inf	21 to inf	13½ to inf
25	13⅓' x 19½'	22 to 30	20 to 33	18⅔ to 38	17 to 46	15 to 77	10½ to inf
15	8' x 11½'	13⅔ to 16½	13 to 17½	12⅓ to 18⅚	11⅔ to 21	10⅔ to 25	8⅓ to 79
10	5¼' x 7⅔'	9½ to 10⅔	9⅙ to 11	8⅚ to 11½	8½ to 12⅔	7⅚ to 13⅓	6½ to 22
8	4⅙' x 6'	7⅔ to 8⅓	7½ to 8½	7¼ to 9	7 to 9⅔	6¾ to 10⅚	5⅔ to 14
6	3¼' x 4¾'	5⅚ to 6¼	5⅔ to 6⅓	5½ to 6½	5⅓ to 6¾	5 to 7	4⅔ to 8⅔
5	2½' x 3⅓'	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5⅙	4⅓ to 5¾	4 to 6⅔
4	2' x 2⅚'	4 to 4	3⅚ to 4⅙	3⅚ to 4¼	3¾ to 4⅓	3⅔ to 4½	3⅓ to 5
3½	1¾' x 2'	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅚	3¼ to 3¾	3¼ to 3⅚	3 to 4¼

*All distances measured to front of lens.

**The depth is not given for *f*/4.5 or *f*/22. For these openings depth can be estimated by comparison.

Lens and Shutter Data:

KODAK WIDE FIELD EKTAR LENSES, 80mm f/6.3; 100mm f/6.3; 135mm f/6.3; 190mm f/6.3; 250mm f/6.3



Covering more than twice the area of good definition obtainable with lenses of conventional design, Kodak Wide Field Ektar Lenses, *f*/6.3, are especially useful for press photography, architectural photography, and similar work in which wider-than-normal coverage is desirable. They are not, however, "special-purpose" lenses, since their versatile performance makes them suitable for all types of photography. As a result of careful design and precision manufacture, Kodak Wide Field Ektar Lenses, *f*/6.3, show no distortion; preserve flatness of field, even at 1 to 1 magnification; and have no significant shift in focus with change in aperture. In addition, lateral color has been completely eliminated, making possible the perfect registration of color-separation negatives made with these lenses. Kodak Wide Field Ektar Lenses are Lumenized and are supplied in flash shutters. At very short subject distances, it is advisable to use the lens at reduced openings when the work to be done is of an exacting nature. Best definition is obtained at *f*/11 or smaller diaphragm openings.

Marked Apertures: *f*/6.3, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32. The 190-mm and 250-mm Wide Field Ektar Lenses also have an *f*/45 aperture.

Maximum Recommended Negative Size and Angle of View:

Focal Length	*Recommended Negative Size without Camera Swings*	*Recommended Negative Size Using Camera Swings*	*Angle of View (Lens Focused at Infinity)**
80mm 3⅛ in.	3¼ x 4¼ in.	2¼ x 3¼ in.	55° x 68°
100mm 4 in.	4 x 5 in.	3¼ x 4¼ in.	54° x 65°
135mm 5 5/16 in.	5 x 7 in.	4 x 5 in.	51° x 67°
190mm 7½ in.	8 x 10 in.	5 x 7 in.	56° x 68°
250mm 10 in.	11 x 14 in.	8 x 10 in.	59° x 71°

*At maximum aperture, for largest recommended negative size, no camera swings.

Shutters: All shutters have built-in flash synchronization.

80 and 100mm lens: Kodak Flash Supermatic. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec, T and B. Class F, M, and Synchronization.

135mm lens: Kodak Flash Supermatic. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200 sec, T and B. Class M and Synchronization.

190mm lens: Ilex Acme Synchro. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/150 sec, T and B. Class F, M, and Synchronization.

250mm lens: Ilex Universal Synchro. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50 sec, T and B. Class M and Synchronization.

Dimensions and Kodak Combination Lens Attachments:

Kodak Wide Field Ektar Lens, *f*/6.3	Over-All Length		Over-All Shutter Diameter		Lens Board Mounting Hole Diameter		Filter Size Maximum Thickness 5mm (3/16")		Kodak Adapter Ring	Kodak Combination Lens Attachments
	mm	*inches*	*mm*	*inches*	*mm*	*inches*	*mm*	*inches*		
80mm	32	1 1/4	55	2 3/16	35	1 3/8	41.25	1 5/8	No. 27*	Series VI
100mm	36	1 7/16	63	2 1/2	38	1 1/2	50.75	2	Special*	Series VII
135mm	43	1 11/16	76	3	48	1 7/8	50.75	2	Not needed**	Series VII
190mm	57	2 1/4	102	4	73	2 7/8	63	2 7/16	Not needed**	Series VIII
250mm	74	2 29/32	127	5	86	3 3/8	82	3 3/16	Not needed**	†

*Kodak Adapter Ring and Kodak Adapter Ring Insert supplied with lens.
**No adapter needed—insert ring supplied with lens.
†No Series size. Cemented filter available on special order.

Optical Data:

Focal Length Kodak Wide Field Ektar Lens, f/6.3		Back Focus*		Flange Focus**		Infrared Focus Shift (½% Focal Length)†		Diameter of Circle of Good Definition (inches)					
								Object at Infinity		Object at 6 Feet		1:1 (Unit) Magnification	
mm	*inches*	*mm*	*inches*	*mm*	*inches*	*mm*	*inches*	*f*/6.3	*f*/16	*f*/6.3	*f*/16	*f*/6.3	*f*/16
80	3 1/8	72	2 27/32	79.10	3 7/64	0.40	0.02	4 11/16	5 5/16	4 7/8	5 1/2	8 7/8	9 7/8
100	4	90.25	3 9/16	101.25	4	0.40	0.02	6	6 5/8	6 3/16	7	11	12 1/2
135	5 5/16	120.2	4 3/4	132.20	5 7/32	0.68	0.03	8	9	8 11/16	9 5/8	15 5/8	17 1/2
190	7 1/2	167.5	6 5/8	179.4	7 1/16	0.95	0.04	11 3/16	12 1/2	12 3/8	13 13/16	21 1/2	24 5/16
250	10	223.0	8 3/4	248.2	9 3/4	1.25	0.05	15	16 5/8	17	19	29	32

*Back Focus—Distance from rear lens surface to image when focused at infinity.

**Flange Focus—Distance from rear surface of mounting flange (front of lens board) to image when lens is focused at infinity.

†Extend lens from visual focus by distance indicated.

Hyperfocal Distance: Same as near limit of depth of field at infinity. See below and on the next page.

Depth of Field: Kodak Wide Field Ektar Lens, 80mm *f*/6.3

Distance Focused On—Ft	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
	f/6.3	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
INF	86 to inf	68 to inf	49 to inf	34 to inf	25 to inf	17 to inf
100	42 to inf	36 to inf	29 to inf	22 to inf	17 to inf	12 1/2 to inf
50	29 to 164	26 1/2 to inf	22 1/2 to inf	18 to inf	14 1/2 to inf	10 to inf
25	18 3/4 to 38	17 1/2 to 45	15 1/2 to 65	13 1/2 to 94	11 1/4 to inf	9 to inf
15	12 1/2 to 19	11 3/4 to 20 1/4	11 to 23 1/2	9 3/4 to 32	8 3/4 to 55	8 to inf
10	8 3/4 to 11 1/2	8 1/2 to 12	8 to 13 1/4	7 1/4 to 15 1/2	6 2/3 to 19 1/2	5 5/6 to 40
8	7 1/4 to 9	7 1/6 to 9 1/3	6 3/4 to 10	6 1/4 to 11 1/6	5 3/4 to 13	5 1/6 to 19 3/4
6	5 1/2 to 6 1/2	5 1/3 to 6 3/4	5 1/4 to 7	5 to 7 2/3	4 2/3 to 8 1/2	4 1/4 to 10 1/2
5	4 2/3 to 5 1/3	4 1/2 to 5 1/2	4 1/3 to 5 3/4	4 1/4 to 6	4 to 6 1/2	3 5/6 to 7 1/2
4	3 5/6 to 4 1/6	3 3/4 to 4 1/3	3 2/3 to 4 1/2	3 1/2 to 4 3/4	3 1/3 to 4 5/6	3 1/6 to 5 1/2
3 1/2	3 1/3 to 3 2/3	3 1/4 to 3 3/4	3 1/6 to 3 5/6	3 1/8 to 4	2 5/6 to 4 1/3	2 3/4 to 4 1/2

Depth of Field: Kodak Wide Field Ektar Lens, 100mm *f*/6.3

Distance Focused On—Ft	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
	f/6.3	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
INF	90 to inf	71 to inf	51 to inf	35 to inf	26 to inf	18 to inf
100	53 to inf	41 to inf	33 to inf	25 to inf	21 to inf	15 to inf
50	32 to 113	29 to 170	25 to inf	20 to inf	17 to inf	13 1/2 to inf
25	19 1/2 to 35	18 1/2 to 38	17 to 48	15 to 83	12 3/4 to inf	10 1/2 to inf
15	13 to 18	12 1/2 to 19	11 3/4 to 21	10 1/3 to 26	9 1/2 to 36	8 to 93
10	9 to 11 1/4	8 3/4 to 11 1/2	8 1/3 to 12 1/2	7 2/3 to 15	7 1/4 to 16 1/4	6 1/2 to 23
8	7 1/3 to 8 3/4	7 1/6 to 9	7 to 9 1/2	6 1/3 to 10 1/2	6 1/4 to 11 1/2	5 1/2 to 14 1/2
6	5 2/3 to 6 1/2	5 1/2 to 6 1/2	5 1/3 to 6 3/4	5 1/6 to 6 5/6	5 to 7 2/3	4 1/2 to 8 5/6
5	4 2/3 to 5 1/3	4 2/3 to 5 1/3	4 2/3 to 5 1/2	4 1/2 to 5 3/4	4 1/4 to 6 1/6	4 to 6 3/4
4	3 5/6 to 4 1/6	3 5/6 to 4 1/4	3 3/4 to 4 1/3	3 2/3 to 4 1/2	3 1/2 to 4 2/3	3 1/3 to 5
3 1/2	3 1/3 to 3 2/3	3 1/3 to 3 2/3	3 1/4 to 3 3/4	3 1/6 to 3 5/6	3 1/6 to 4	3 to 4 1/4

Depth of Field: Kodak Wide Field Ektar Lens, 135mm *f*/6.3

Distance Focused On—Ft	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
	f/6.3	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
INF	121 to inf	95 to inf	69 to inf	48 to inf	35 to inf	24 to inf
100	55 to inf	49 to inf	41 to inf	32 to inf	26 to inf	19 to inf
50	35 to 85	33 to 105	29 to 180	25 to inf	21 to inf	16 to inf
25	21 to 32	20 to 34	18 to 39	16 to 52	14 to 87	12 to inf
15	13½ to 17	13 to 18	12½ to 19	11½ to 22	10½ to 27	9¼ to 40
10	9¼ to 11	9 to 11⅓	8¾ to 11¾	8¼ to 12½	7¾ to 14	7 to 17
8	7⅔ to 8½	7½ to 8¾	7¼ to 9	6⅝ to 9½	6½ to 10¼	6⅛ to 11¾
6	5¾ to 6½	5⅔ to 6⅓	5½ to 6½	5⅓ to 6¾	5⅙ to 7⅙	4⅚ to 7⅚
5	4⅚ to 5⅕	4⅔ to 5⅓	4⅔ to 5⅓	4½ to 5½	4½ to 5¾	4¼ to 6¼
4	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3¾ to 4⅓	3¾ to 4½	3½ to 4⅘
3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3¼ to 3¾	3¼ to 3⅚	3⅛ to 4

Depth of Field: Kodak Wide Field Ektar Lens, 190mm (7½-inch) *f*/6.3

Distance Focused On—Ft	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
	f/6.3	*f*/8	*f*/11	*f*/16	*f*/22	*f*/45
INF	170 to inf	134 to inf	98 to inf	67 to inf	49 to inf	24 to inf
400	120 to inf	94 to inf	69 to inf	57 to inf	44 to inf	23 to inf
200	92 to inf	80 to inf	66 to inf	51 to inf	39 to inf	21 to inf
100	63 to 240	58 to inf	50 to inf	41 to inf	33 to inf	19 to inf
50	39 to 70	36 to 80	33 to 103	29 to 192	25 to inf	16 to inf
25	22 to 29	21 to 31	20 to 34	18 to 40	17 to 51	12 to inf
15	13¾ to 16½	13½ to 17	13 to 18	12¼ to 19½	11 to 22	9 to 40
10	9½ to 10⅔	9⅓ to 11	9⅙ to 11⅓	8¾ to 11¾	8⅓ to 12½	7 to 17
8	7⅔ to 8½	7⅔ to 8½	7½ to 8¾	7⅛ to 9⅛	6⅚ to 9⅔	6 to 12
6	5⅚ to 6⅙	5¾ to 6⅓	5⅔ to 6½	5⅔ to 6⅔	5½ to 6¾	4¾ to 8
5	4⅚ to 5⅙	4¾ to 5¼	4¾ to 5½	4½ to 5½	4½ to 5⅔	4⅙ to 6½
4	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4⅓	3½ to 4¾
3½	3½ to 3½	3½ to 3⅔	3½ to 3⅔	3⅓ to 3¾	3⅓ to 3¾	3 to 4

The depth is not given for *f*/32. For this opening depth can be estimated by comparison.

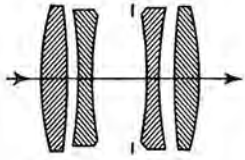
Depth of Field: Kodak Wide Field Ektar Lens, 250mm (10-inch) *f*/6.3

Distance Focused On—Ft	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc. This equals approximately 1/1720 of the lens focal length and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
	f/6.3	*f*/8	*f*/11	*f*/16	*f*/22	*f*/45
INF	227 to inf	179 to inf	130 to inf	90 to inf	65 to inf	32 to inf
400	146 to inf	124 to inf	98 to inf	73 to inf	56 to inf	29 to inf
200	107 to inf	95 to inf	79 to inf	62 to inf	49 to inf	27 to inf
100	70 to 178	64 to inf	57 to inf	47 to inf	39 to inf	24 to inf
50	41 to 64	39 to 69	36 to 81	32 to 113	28 to 214	19 to inf
25	22½ to 28	22 to 39	21 to 31	20 to 35	18 to 40	14 to 117
15	14 to 16⅙	13⅔ to 16⅔	13½ to 17	13 to 18	12 to 20	10 to 28
10	9⅔ to 10½	9⅔ to 10⅔	9⅓ to 11	9 to 11⅓	8⅔ to 12	7½ to 14
8	7¾ to 8½	7¾ to 8⅓	7⅔ to 8½	7⅓ to 8¾	7¼ to 9⅙	6⅓ to 10¾
6	5⅚ to 6⅙	5¾ to 6⅓	5¾ to 6⅓	5⅔ to 6½	5½ to 6¾	5⅙ to 7⅓
5	4⅚ to 5⅙	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5½	4⅓ to 5¾
4	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½	3½ to 3½	3½ to 3½	3½ to 3½	3½ to 3⅔	3⅓ to 3¾	3¼ to 4

The depth is not given for *f*/32. For this opening depth can be estimated by comparison.

Lens and Shutter Data:

KODAK EKTAR LENS, 8-inch *f*/7.7



This lens, primarily intended for the Kodak View Camera, No. 2D, and other 5 x 7 cameras, is of the symmetrical, air-spaced type which retains its corrections to a high degree when used for extreme close-ups. It gives extremely sharp definition over the whole field for all subject distances at maximum lens aperture. This lens is Lumenized and is supplied in a Kodak Flash Supermatic Shutter.

Marked Apertures: *f*/7.7, *f*/11, *f*/16, *f*/22, *f*/32, and *f*/45

Focal Length: 8 inches (203 mm)

Back Focus: 7½ inches (190 mm)

Maximum Recommended Negative Size: 5 x 7 inches

Angle of View: When focused for infinity, 35° x 47°

Infrared Focusing: Lens should be extended .016 inch (.4 mm) from visual focus.

Shutter: Kodak Flash Supermatic. Speeds—1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec, T, and B. Built-in flash synchronization for Class F, and Class M. Blade arrester. Accepts the Kodak TBI Metal Cable Release No. 2 or the Kodak Metal Cable Release No. 5.

Diameter of Lens-Board Mounting Hole: 1½ inches (38 mm)

Size of Kodak Combination Lens Attachments: 1 5/16 in., 33 mm, Series VI

Hyperfocal Distance: Same as near limit of depth of field. See below.

Depth of Field: Kodak Ektar Lens, 8-inch *f*/7.7

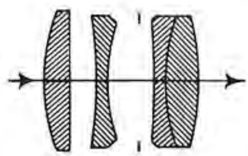
Distance Focused On—Ft	Approximate Field Size with 5 x 7" Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc.*				
		f/7.7	*f*/11	*f*/16	*f*/22	*f*/45
INF	35° x 47°	149 to inf	104 to inf	72 to inf	52 to inf	26 to inf
200	124' x 174'	86 to inf	68 to inf	53 to inf	41 to inf	23 to inf
100	62' x 87'	60 to 304	51 to inf	42 to inf	34 to inf	21 to inf
50	31' x 43'	37 to 75	34 to 96	30 to 165	26 to inf	17 to inf
25	15' x 21'	21 to 30	20 to 33	18 to 38	17 to 48	13 to inf
15	8 3/8' x 12 1/4'	14 to 17	13 to 18	12 1/2 to 19	11 3/4 to 21	9 1/3 to 36
10	5 3/4' x 8 1/4'	9 1/2 to 10 3/4	9 1/6 to 11 1/4	8 5/8 to 11 3/4	8 1/3 to 12 1/3	7 1/4 to 16 1/2
8	4 2/3' x 6 1/2'	7 2/3 to 8 1/2	7 1/3 to 8 2/3	7 1/4 to 9	6 5/8 to 9 1/2	6 1/6 to 11 2/3
6	3 1/3' x 4 2/3'	5 3/4 to 6 1/4	5 3/4 to 6 1/2	5 2/3 to 6 2/3	5 1/2 to 6 3/4	4 5/8 to 8
5	2 3/4' x 3 3/4'	4 3/4 to 5 1/4	4 3/4 to 5 1/4	4 3/4 to 5 1/3	4 3/8 to 5 1/2	4 1/2 to 6 1/3
4	2' x 2 7/8'	3 5/8 to 4 1/8	3 5/8 to 4 1/8	3 3/4 to 4 1/4	3 5/8 to 4 1/3	3 1/2 to 4 3/4
3 1/2	1 3/4' x 2 1/2'	3 1/2 to 3 1/2	3 1/2 to 3 1/2	3 1/2 to 3 2/3	3 1/3 to 3 3/4	3 1/6 to 4

The depth is not given for *f*/32. For this opening depth can be estimated by comparison.

*This equals about 1/1720 of the focal length and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.

Lens and Shutter Data:

KODAK COMMERCIAL EKTAR LENSES
8½-inch *f*/6.3; 10-inch *f*/6.3; 12-inch *f*/6.3; 14-inch *f*/6.3



These lenses meet the most critical requirements in color photography and are recommended for making exposures with Kodak color sheet films or for making color-separation negatives. It follows, therefore, that they are also suitable for black-and-white picture taking. They are not recommended for enlarging or projection printing. When the lenses are used at maximum aperture, the image size on the ground glass should not be larger than about one-third the subject size. At small apertures they perform satisfactorily even at lens-to-subject distances giving an image size of about 1 to 1.

The Kodak Commercial Ektar Lenses are exceedingly well corrected for lens aberrations, such as coma, astigmatism, curvature of field, and spherical and chromatic aberration, both lateral and longitudinal. The lenses are Lumenized.

The four *f*/6.3 lenses described here cover at full aperture an angle of 53° and at small stops an angle of 64°. For example, the 14-inch *f*/6.3 lens covers adequately the recommended negative size (8 x 10 inches) at maximum aperture with allowance for full use of the rising and falling front and swing back. At apertures below *f*/16 its 64° covering power permits its use on an 11 x 14-inch camera but without allowance for swing back or rising and falling front.

Kodak Commercial Ektar Lenses are available in shutter or in barrel.

Marked Apertures: *f*/6.3, *f*/8, *f*/11, *f*/16, *f*/22, *f*/32, and *f*/45. In barrel, the diaphragm setting ring has click stops. As each marked *f*-number passes the index mark, a distinct click is heard and felt.

Focal Length, Maximum Recommended Negative Size, and Angle of View:

Focal Length	*Recommended Negative Size*	*Angle of View (Lens Focused at Infinity)*
8½ in. 216 mm	5 x 7 in.	33° x 45°
10 in. 254 mm	6½ x 8½ in.	36° x 46°
12 in. 304 mm	8 x 10 in.	37° x 45°
14 in. 356 mm	8 x 10 in.	32° x 40°

Infrared Focusing: Lens should be extended from visual focus as follows:

.008 in. (.2 mm) for 8½-in. lens
.012 in. (.3 mm) for 10- in. lens
.016 in. (.4 mm) for 12-in. lens
.031 in. (.8 mm) for 14-in. lens

Shutter: Ilex Synchro with built-in flash synchronization. Speeds—

8½-in. lens: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200 sec, T and B. Class F, Class M, and Synchronization.

10- and 12-in. lenses: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/150 sec, T and B. Class F, Class M, and Synchronization.

14-in. lens: 1, 1/2, 1/5, 1/10, 1/25, 1/50 sec, T and B. Class M and Synchronization.

Diameter of Lens-Board Mounting Hole:

8½-in. lens—2⅛ in., 54 mm
10- in. lens—2⅝ in., 67 mm
12-in. lens—2⅞ in., 73 mm
14-in. lens—3⅜ in., 86 mm

Size of Kodak Combination Lens Attachments:

8½-in. lens—1¾ in., 44.5 mm, Series VII
10- in. lens—2⅛ in., 54 mm, Series VIII
12- in. lens—2½ in., 63.5 mm, Series VIII
14- in. lens—No. 91 (72mm) Series IX.

Hyperfocal Distance: Same as near limit of depth of field. See next page.

Depth of Field: Kodak Commercial Ektar Lens, 8½-inch f/6.3

Distance Focused On—Ft	Approximate Field Size with 5 x 7" Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc.*				
		f/6.3	f/11	f/16	f/22	f/45
INF	33° x 45°	193 to inf	111 to inf	76 to inf	55 to inf	27 to inf
200	117' x 163'	98 to inf	71 to inf	55 to inf	43 to inf	24 to inf
100	58' x 82'	66 to 208	53 to inf	43 to inf	36 to inf	21 to inf
50	29' x 41'	40 to 68	34 to 91	30 to 146	26 to inf	18 to inf
25	14' x 20'	22 to 29	20 to 32	19 to 37	17 to 46	13 to inf
15	8½' x 12'	14 to 16½	13 to 17½	12½ to 19	12 to 21	9½ to 34
10	5½' x 7⅔'	9⅓ to 10⅔	9 to 11	8⅚ to 11⅓	8½ to 12	7⅓ to 16
8	4⅓' x 6'	7⅓ to 8⅓	7½ to 8⅔	7¼ to 8⅚	7 to 9⅓	6 to 11
6	3⅚' x 4⅓'	5⅚ to 6⅙	5⅔ to 6½	5½ to 6¼	5⅓ to 6¾	5 to 7½
5	2⅓' x 3⅓'	4⅚ to 5⅙	4¾ to 5¼	4½ to 5½	4⅔ to 5⅓	4⅙ to 6½
4	2' x 2¾'	3⅚ to 4⅙	3⅚ to 4¼	3⅚ to 4¼	3⅔ to 4½	3½ to 4¾
3½	1⅔' x 2¼'	3⅓ to 3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅝	3 to 4

Depth of Field: Kodak Commercial Ektar Lens, 10-inch f/6.3

Distance Focused On—Ft	Approximate Field Size with 6½ x 8½" Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc.*				
		f/6.3	f/11	f/16	f/22	f/45
INF	36° x 46°	227 to inf	130 to inf	90 to inf	65 to inf	32 to inf
400	259' x 339'	146 to inf	98 to inf	73 to inf	56 to inf	29 to inf
200	129' x 169'	107 to inf	79 to inf	62 to inf	49 to inf	27 to inf
100	65' x 85'	70 to 178	57 to inf	47 to inf	39 to inf	24 to inf
50	32' x 42'	41 to 64	36 to 81	32 to 113	28 to 214	19 to inf
25	16' x 21'	22½ to 28	21 to 31	20 to 35	18 to 40	14 to 117
15	9' x 12'	14 to 16⅙	13½ to 17	13 to 18	12 to 20	10 to 28
10	6' x 8'	9¼ to 10½	9⅓ to 11	9 to 11⅓	8⅔ to 12	7⅓ to 14
8	4⅔' x 6'	7¼ to 8⅓	7⅔ to 8½	7½ to 8¾	7¼ to 9⅓	6⅓ to 10¾
6	3½' x 4¼'	5⅚ to 6⅙	5¾ to 6⅓	5⅔ to 6½	5½ to 6¾	5⅙ to 7⅓
5	2⅔' x 3⅓'	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5½	4⅓ to 5¾
4	2' x 2¾'	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½	1¾' x 2¼'	3⅓ to 3⅔	3½ to 3½	3⅓ to 3⅔	3⅓ to 3¾	3¼ to 4

Depth of Field: Kodak Commercial Ektar Lens, 12-inch f/6.3

Distance Focused On—Ft	Approximate Field Size with 8 x 10" Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc.*				
		f/6.3	f/11	f/16	f/22	f/45
INF	37° x 45°	273 to inf	156 to inf	107 to inf	78 to inf	38 to inf
400	266' x 332'	162 to inf	112 to inf	85 to inf	65 to inf	35 to inf
200	133' x 166'	115 to inf	88 to inf	70 to inf	56 to inf	32 to inf
100	66' x 83'	73 to 158	61 to 278	52 to inf	45 to 310	28 to inf
50	33' x 41'	42 to 61	38 to 74	34 to 94	31 to 139	22 to inf
25	16' x 20'	23 to 27	21 to 30	20 to 33	19 to 37	15 to 73
15	9⅓' x 12'	14½ to 16	13½ to 17	13 to 17½	12½ to 19	11 to 25
10	6' x 7½'	9¼ to 10½	9¼ to 10⅝	9⅙ to 11⅙	8⅚ to 12	8 to 14
8	4⅔' x 5¾'	7⅓ to 8¼	7⅔ to 8½	7½ to 8⅔	7⅓ to 8⅚	6⅔ to 10⅙
6	3⅓' x 4⅙'	5⅚ to 6¼	5¾ to 6⅓	5¾ to 6⅓	5⅔ to 6⅔	5¼ to 7
5	2⅔' x 3⅓'	4⅚ to 5⅙	4⅚ to 5⅙	4⅚ to 5⅙	4¾ to 5⅓	4½ to 5¾
4	2' x 2½'	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½	1⅔' x 2⅙'	3⅓ to 3⅔	3½ to 3½	3½ to 3⅔	3⅓ to 3⅔	3¼ to 3⅚

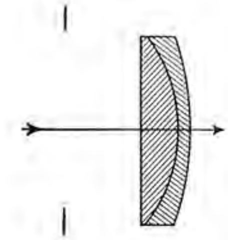
Depth of Field: Kodak Commercial Ektar Lens, 14-inch f/6.3

Distance Focused On—Ft	Approximate Field Size with 8 x 10" Neg	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2 min arc.*				
		f/6.3	f/11	f/16	f/22	f/45
INF	32° x 40°	318 to inf	182 to inf	125 to inf	92 to inf	45 to inf
400	228' x 285'	177 to inf	125 to inf	95 to inf	74 to inf	41 to inf
200	113' x 142'	123 to 540	96 to inf	78 to inf	63 to inf	36 to inf
100	56' x 71'	76 to 146	65 to 220	56 to inf	48 to inf	31 to inf
50	28' x 35'	44 to 59	39 to 69	36 to 84	32 to 110	24 to 574
25	14' x 17'	23 to 27	22 to 29	21 to 31	19 to 34	16 to 61
15	8' x 10'	14½ to 16	14 to 16½	13½ to 17	13 to 18	11¼ to 23
10	5' x 6¼'	9¼ to 10⅓	9½ to 10¾	9¼ to 11	9 to 11½	8⅓ to 13
8	3⅚' x 4⅚'	7¼ to 8¼	7¾ to 8⅓	7⅔ to 8½	7½ to 8¾	6¼ to 9¾
6	2¾' x 3½'	5⅞ to 6⅙	5¾ to 6⅓	5¾ to 6⅓	5⅔ to 6½	5⅓ to 6⅚
5	2¼' x 2¾'	4⅚ to 5⅙	4⅚ to 5⅙	4⅚ to 5¼	4¾ to 5⅓	4½ to 5¾
4	1⅔' x 2'	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4¼	3⅔ to 4½
3½	1⅓' x 1⅔'	3⅓ to 3⅔	3½ to 3½	3½ to 3½	3¼ to 3⅔	3⅓ to 3¾

The depth is not given for *f*/8 or *f*/32. For these openings depth can be estimated by comparison.
*This equals about 1/1720 of the focal length, and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work, the depth of field is greater.

Lens and Shutter Data:

KODAK PORTRAIT LENSES, 12-inch and 16-inch f/4.5



The Kodak Portrait Lenses have identical visual and photographic images. With them, the photographer can see on the ground glass the exact effect he will achieve before releasing the shutter, and he can vary the soft-focus effect by varying the aperture. When the lens is used wide open at *f*/4.5, the soft-focus effect is most pronounced, while at *f*/22, the effect disappears almost completely. The design of the lenses is such that at the larger stops each highlight point in the scene will be surrounded by a soft halo. For best results with this lens, the exposure should never be made at a smaller stop than was used for focusing. The lenses are equally suitable for both black-and-white and color. These lenses are Lumenized to minimize flare and increase color saturation.

Marked Apertures: *f*/4.5, *f*/6.3, *f*/8, *f*/11, *f*/16, and *f*/22.

Focal Length: 12 in. and 16 in.

Negative Sizes: 5 x 7 in. and 8 x 10 in.

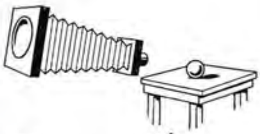
Angle of View: When focused for infinity, 48°

Shutter: 12 in. lens—No. 5 Ilex Universal Synchro Shutter
16 in. lens—supplied in barrel only

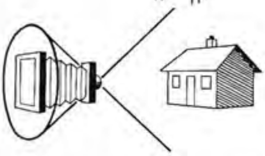
Points of Interest

- Visual and photographic foci are the same.
- The photographic focus is not influenced by the color sensitivity of the film.
- Two focal lengths: 12 and 16 inches, covering 5 by 7-inch and 8 by 10-inch films, respectively.
- The lenses are Lumenized to cut down flare and increase color saturation.
- Soft at f/4.5, sharp at f/22—the maximum and minimum lens apertures.
- Highlights at f/4.5 display the desired pearly qualities.
- Fully color corrected for use with any color material.

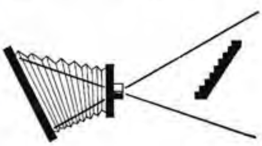
View Camera Adjustments in brief



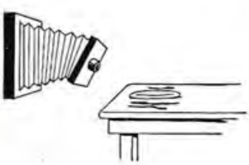
A long bellows draw is required for very long focus lenses, or for large images of small objects.



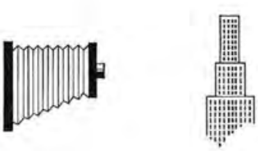
The full use of view camera adjustments requires a lens with adequate covering power.



The swing back (horizontal and vertical) (a) is used to rectify image distortion or (b) to adjust the focal plane to the depth requirements of the subject.



The tilting lens (horizontal and vertical) positions lens so that plane of sharp focus coincides with the principal plane of the subject.



The rising and falling front (and/or *horizontal slide)* secures correct lens and film relationship for cases when the subject is not on the camera axis.

The rotating back rotates the negative as desired to fit the placement of the subject without the necessity of tilting the camera.

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